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THE ROLE OF COMPETITION IN PHYSICIAN PRICING AND OUTPUT:

A Longitudinal Study in Pennsylvania

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Pennsylvania Blue Shield®

THE ROLE OF COMPETITION IN PHYSICIAN PRICING AND OUTPUT:

A LONGITUDINAL STUDY IN PENNSYLVANIA

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I. STATEMENT OF THE PROBLEM

This longitudinal study of physician competition, pricing, and output is one of the major analytic phases of a larger overall project addressing a variety of issues and questions in the market for physicians' services in Pennsylvania. The scope of the overall project effort includes studies of physician pricing patterns, characteristic pricing behaviors, factors related to physician pricing practices, alternative physician reimbursement system designs, and Blue Shield participation and Medicare assignment. The studies emphasize use of empirical physician price and output data derived from paid claims history files for Medicare Part B and private Blue Shield claims submitted to Pennsylvania Blue Shield (PBS). Most of the work in this study series is based upon an extensive cross-sectional data base for the year 1975. The study phase reported here, however, is based upon a related longitudinal data base spanning the period 1973 through 1978.

A. INTRODUCTION AND OBJECTIVES

The spiraling cost of physician services with the spread of public and private insurance has led to extensive public intervention in the market for physician services. Fees are regulated, supply is manipulated in various ways, and utilization controls are applied. Much of the regulation and planning effort, however, has been frustrated by unintended side-effects. Greater supplies of physicians have led to increased access and utilization with little or no decline in fees. The mix of services

has become more complex, due in part to technological advances in medicine, but also to an apparent effort by physicians to maintain incomes at desired levels.

The study presented in this report is designed to address the public policy concern over the best way to control expenditures in the physician market. First, and most important, is the general question of physician-induced demand. In the face of increased competition, do physicians induce more demand for their services in order to preserve established income-leisure preferences? Physician-induced demand is still a very controversial issue in the economics profession. Many neoclassical economists have taken issue with the conventional wisdom that physicians, as imperfect consumer agents, encourage unnecessary utilization of medical services. Arguments against induced demand include:

(1) Absence of a theoretical foundation for explaining why physicians differ in their inducement or why they don't all induce up to the limit of their capabilities;

(2) Misspecification of geographic market areas in empirical work (e.g., bordercrossing);

(3) Omitted variables which affect price and quality of product (e.g., waiting and travel time, amenities);

(4) Lower physician incomes in physician dense areas; and

(5) Constant markups over costs across areas with different physician densities.

Certainly others exist as well. While in any study imaginable one can conjure up a defense of the no-inducement theory, the defense usually misses the public policy issue of unnecessary utilization. Economists consider "unnecessary" either a personal value judgment or a function of medical opinion and hence out of the realm of economic analysis. So long

as consumers are moving down along a fixed demand curve, shifting (inducement) has not occurred.

But even if demand remained constant, the question of appropriate utilization remains. Why? Because of insurance and the resulting moral hazard. Consumers will consume health services beyond socially optimal levels unless physicians act as perfect societal agents, a highly unlikely situation (and against the Hippocratic Oath in many instances). Therefore, it is valuable to determine utilization patterns across geographic areas, even if demand remains constant. If, in addition, extra utilization in physician-rich areas is not all price-induced, the problem of unnecessary utilization is compounded. It is the intention of this study to investigate physician volume and pricing more carefully, trying as much as possible to redress limitations in the existing empirical literature (e.g., bordercrossing, price differences).

We are interested in exploring the sources of fee differentials in various ways, testing hypotheses regarding the extent of institutional price discrimination, how discrimination varies by procedure, and in what ways physician-density ratios influence the price and utilization of physician services. Answers to each of these questions would shed light on the best way of regulating health care costs.

The study phase addressed in this report has the following objectives:

(1) Construct a longitudinal cross-section of physician utilization and fees for the period 1973-78 across substate physician market areas in Pennsylvania using Pennsylvania Blue Shield-Medicare claims data. Utilization and fees will be decomposed by 23 procedures in the following major benefit categories: surgery, hospital visits, office visits, radiology, pathology, EKG, consultation, obstetric delivery;

(2) From the longitudinal cross-section, calculate rates of change in utilization and fees and present in tabular form for Pennsylvania as a whole and for relevant analytical subcomponents (e.g., high-low physician population [MDPOP] ratio);

(3) Conduct an econometric test of physician inducement using fees for each procedure in a reduced-form regression on MDPOP, holding relevant demand and supply variables constant.

B. BACKGROUND

The single most striking fact about the national health care budget is its size. Total health expenditures in 1980 were $247 billion, or 9.4 percent of the Gross National Product (Gibson, 1981). The public share of this budget was $98 billion, up more than ten-fold from 1965. A large proportion of these health care costs are dependent on the physician, either directly through physician expenditures or indirectly through hospital admissions, laboratory tests, and other procedures ordered by the physician.

Expenditures for physicians' services alone are estimated at $35 billion in 1978, a 161 percent increase from 1970 (Dyckman, 1978). Based on 1976 data, we can project physician outlays of $4.69 billion and $2.33 billion under Medicare and Medicaid programs, respectively. This dramatic increase in physician expenditures can be decomposed into two parts: fee inflation and increased utilization. On average from 1970 to 1976, physicians' fees rose 7.8 percent per year compared with only 6.5 percent annually for all non-medical care prices (Dyckman, 1978). During 1977, fees increased 9.2 percent while non-medical care items in the Consumer Price Index increased 6.6 percent. At the same time, physician visit

rates have been rising nationwide. The _per capita_ number of surgical operations, for example, has increased 17 percent from 68 to 1,000 population in 1969 to 79 per 1,000 in 1976 (AMA).

The government has three potentially powerful tools at its disposal to control medical care expenditures: (1) controlling the supply of physicians; (2) physician fee setting; (3) utilization controls. If physicians are able and willing to "shift" demand for their services, however, these policies may lead to unanticipated results.

Public health care policy and economic research in the field of physician behavior currently exhibit schizophrenic tendencies, born out of frustrated attempts to explain, then control, the spiraling inflation in medical care costs. Earlier policies, designed to increase access to physician care by increasing physician supply, held out the hope that through increased competition among suppliers, costs could be controlled as well. But something went wrong. Although access improved significantly (see, for example, Davis and Reynolds, 1976), expenditures on physician services escalated considerably more than the increases in per capita utilization. Clearly, expanding supply was not having the expected depressing effect on unit prices predicted by orthodox economic theory. Well-intentioned policy directed at increasing market competition, as opposed to government regulation, was not working.

Then, reinforced by studies forecasting the end of physician shortages on an aggregate basis, there was a dramatic reversal of policy direction, calling for new constraints on the production of medical school graduates and importation of Foreign Medical Graduates (FMGs). This redirection was bolstered, in part, by mounting evidence that physicians

were exhibiting discretionary control over the demand for their services, thwarting attempts to promote price competition. That physician induced demand plays a dominant role in medical care utilization is by no means generally accepted, however, by either physicians or economists. Many deny such a role on theoretical and/or policy grounds. More traditional economists find the notion of unbridled induced demand unacceptable, for it undermines most of the predictive and normative conclusions derived from theory. Furthermore, it renders useless the more traditional forms of regulatory intervention, calling for more radical solutions to the cost crisis. Why? Because price or quantity regulation can be offset by physician-induced demand shifts, leaving total revenues unchanged. Only if price and quantity are simultaneously regulated can public policy have any hope of constraining expenditures.

Policymakers are faced with a serious dilemma. Should they deregulate the market and permit more competition in the hope that the proper incentive structure will lead to improved efficiency and lower costs, or should they give up on the market solutions, fully recognize the unique characteristics of the market militating against real competition, and accelerate regulatory efforts? Neither is an obvious choice. The evidence in favor of market-imposed cost constraints in the face of rising insurance coverage is limited indeed. On the other hand, little comfort is derived from experience with regulatory intervention in other industries. Particularly discomforting is the so-called "tarbaby syndrome," <u>viz.</u>, as one regulation is put into place, pressures build, leading to perverse responses requiring further regulation. Eventually, a jungle of overlapping regulations strangles any innovative, competitive

elements left in the industry, leaving the survivors to "enjoy" a protected market.

Other explanations, however, seem to beg the question of what to do with physician regulation, although the clear implication is that the market is functioning properly and little regulation is required. For example, it has recently been asserted in a strong theoretical context by Sloan and Feldman (1978) that part of the positive correlation between physician-population ratios, fees, and per capita utilization can be attributed to lower time prices and increased amenities to patients living in physician-rich areas. While it is, strictly speaking, true that abstract demand functions should incorporate both the prices and variations in the nature of the product, it is not clear what policy prescriptions result from incorporating them. If patients enjoy more physician visits because of lower time prices, should public and private insurance programs pay for these visits? If physicians are willing to provide more amenities -- e.g., nicer waiting rooms, more time with patients -- should society pay for these amenities? Policymakers would be much less concerned about shifts of this nature if: (a) patients were paying for these amenities out-of-pocket, or (b) the higher fees resulting from a higher amenity-intensive service mix did not eventually increase the reimbursement rates of public insurers. Under UCR methods, however, usual physician charges enter directly into the calculation of usual and customary reimbursement rates. Thus, public payments are often higher in physician-rich areas, adjusted for cost-of-living, because of higher amenity levels and stronger private demand due to lower time prices.

There is no question that physician-induced demand is a serious

problem from a policy perspective. If it exists, and if it plays a major role in medical care utilization, then it must be taken very seriously. A radical rethinking of the modes of intervention would be required in order to control costs as the "natural constraints," i.e., consumer sovereignty, would be missing from the regulatory equation. In the final analysis:

> society must decide whether a centralized system (public-sector allocation) will make fewer errors than a decentralized system with inducement. An estimate of the amount of inducement could inform that decision. If the amount of inducement is small, the misallocation from inducement will be correspondingly small, and under such circumstances a decentralized system may well be preferable. (Fuchs and Newhouse [1978, p. 10]).

C. SUMMARY OF FINDINGS

The issue of physician-induced demand was explored in this study using a longitudinal data file derived from Pennsylvania regular Blue Shield business plus Medicare claims reimbursements over a six-year period, 1973-1978. Charges, payments, workloads, and patient utilization (or intensity) rates were determined on a per procedure basis for 23 selected procedures: 11 surgical; 6 visits; and 6 nonsurgical diagnostic tests. The data base included claims from a panel of 8,099 physicians, each performing at least one of the 23 procedures continuously throughout the six years. Aggregate price and quantity indices for each physician were then calculated using data from all 23 procedures, with relative prices forming the aggregation weights. Finally, all pecuniary data were deflated by a regional cost-of-living index, although no explicit time-series deflator was used because of the lack of such an index on a substate basis. Thus, aggregate price and payment data reflect

regionally (but not temporally) deflated prices per RVU, while workloads and intensity are in terms of RVUs per physician and per patient. Systematic differences in physician prices and output, therefore, cannot be attributed either to service mix or to regional cost effects.

The analysis included a variety of descriptive and econometric work, hierarchically ordered from the most aggregated, per physician, level to the most disaggregated, per procedure, level. Findings are summarized by topic area (e.g., fees) by type of analysis (descriptive, econometric).

1. Fees

Overall fees per RVU rose 9.1 percent per year, from $5.92 per RVU in 1973 to $8.60 in 1978. Econometrically adjusting for trends in demand (e.g., income, insurance coverage), the rate of fee inflation was still about 6.5 percent. The biggest adjusted yearly increase (9 percent) came in 1975, the year after wage-price controls were removed.

Absolute fees per RVU varied directly with the extent of physician concentration. In areas with the highest physician-population (MDPOP) ratio, charges per RVU in 1975 were $7.36, a full 14 percent above the average charge in low MDPOP areas ($6.48).

Fees per RVU rose at about the same, undeflated, 9 percent per annum in all areas, essentially independent of physician concentration. Nor was any measure of physician availability correlated with weighted fees per RVU in the aggregate fee regressions.

From these results we conclude that more physicians per capita, while not raising fees overall, does not depress fees either. The lack of strong negative correlation has serious implications for future Medicare

and health care expenditures on physicians' services, what with the rapid growth in supply projected through 1990.

Fee levels and trends varied both by specialty and by procedure. Average fees per RVU in 1978 were as follows:

Specialty	1978 Fee/RVU	1973-'78 Pct. Δ Fee/RVU
OB-GYNs	$10.04	57%
Surgical specialists	9.22	47
Medical specialists	9.08	46
Other specialists	9.06	38
General Surgeons	8.85	51
Internists	8.75	44
General practitioners	7.64	42
All physicians	8.56	45

Obstetricians and gynecologists had by far the highest fees per RVU, followed by surgical specialists (e.g., neurosurgeons, orthopedic surgeons, and ophthalmologists), medical specialists (e.g., cardiologists, pediatricians, neurologists), and other specialists (e.g., psychiatrists, radiologists, pathologists). General practitioners had the lowest charges per RVU, about 25 percent below OB-GYNs, and 12.7 percent below the surgical/medical specialists, holding other variables like board certification constant.

The rate of fee inflation was highest, as well, for OB-GYNs (57 percent over five years), while other specialists exhibited the lowest rate (38 percent); GP fees per RVU rose 42 percent; general surgeons, 51 percent.

Fee inflation, while not differing by specialty across high, medium, and low physician-population (MDPOP) market areas, does show an

absolute widening of the fee gap. For example, GP fees per RVU were $.76 higher in high MDPOP areas than low areas in 1973, the gap widening to $1.20 by 1978. Such gaps cannot be explained either by specialty or procedure mix, nor can they be attributed to regional cost-of-living differentials.

Among the individual procedures, tonsillectomy fees rose the fastest, 13.3 percent yearly, followed by vaginal deliveries and D&Cs, at 12.9 percent. Lens excisions and resection of prostate surgery had the lowest increases among surgical procedures, 8.7 and 9.3 percent, respectively.

Fee inflation for office and hospital visits was somewhat lower, averaging between 7.5 and 11.0 percent annually. A definite shift away from brief to intermediate office or hospital visits was observed, however, which left the number of visits per patient seen constant. This upgrading contributed only

to the rate of visit expenditure inflation, however, due in part to the slower growth in intermediate visit fees relative to brief visits.

The six diagnostic tests exhibited the lowest inflation rates, ranging from 3.6 percent (complete blood count) to 6.5 percent (upper GI) per year. In 1973, the six tests averaged $21.28 per patient seen, increasing to $26.22 in 1978, a 25 percent increase.

While the rate of fee inflation for individual procedures was generally uncorrelated with the extent of physician competition, absolute fees, regionally adjusted for cost-of-living, were positively related to MDPOP, although not for every procedure. The following are illustrative of the fee differentials across high and low MDPOP areas as of 1978:

Procedure	High MDPOP	Low MDPOP	High/Low
Colles Fracture	$165.02	$164.71	1.00
Tonsillectomy	162.67	164.04	.99
Prostate Resection	640.81	574.42	1.11
D&C	171.29	137.76	1.24
Delivery	434.68	324.85	1.34
Brief Office Visit	9.57	8.73	1.10
Intermediate Hospital Visit	14.29	12.02	1.19
Chest X-ray	23.12	21.74	1.07
EKG	20.15	19.74	1.03
Urinalysis	3.47	2.99	1.16

Differentials for OB-GYN procedures and urinalysis proved to be much greater than for other procedures.

Econometric results holding exogenous supply and demand factors constant, while showing no competitive effects on overall fees, did exhibit definite effects when disaggregated by specialty or procedure. For the sample of 2,584 GPs and FPs, average fees per RVU were lower in areas where these physicians were more plentiful relative to the population. The effect, however, is relatively small: a doubling of GPs per capita reduces average GP fees per RVU about $.34, an elasticity of .06. Offsetting this negative own supply effect on GP fees is a positive, statistically significant cross-price effect of non-GPs; that is, GPs practicing in areas with more physicians per capita charge higher fees, thereby diluting much of the effect of own-specialty competition. This finding is consistent with previous work by Steinwald and Sloan (1974).

Results from the medical and surgical equations reveal some additional evidence of inducement. The relative supply of medical specialists was found to be positively related to average medical

specialists' fees per RVU (an elasticity of .037) while the relative number of direct patient care physicians was positively correlated with surgical fees (an elasticity of .02), although the own-specialty effect was insignificant. GP supplies, by contrast, were negatively correlated with medical specialists' fees (an elasticity of .09). Apparently for specialists, fee competition is not direct among peers, but rather, manifests itself indirectly through interspecialty competition. More specifically, increases in GPs per capita, holding specialist supplies constant, does depress both GP and specialist fees -- particularly medical specialists like internists, pediatricians, dermatologists, and allergists. The rapid phasing out of GPs in favor of specialists does not bode well for the future in terms of competitively lower fees through supply increases alone. Changes in reimbursement arrangements also may be necessary.

Regressions also were run on Medicare-assigning and non-assigning physicians. The results showed that:

- Non-assigning physician fees per RVU were slightly lower than for assigners (holding specialty, etc. constant); however,
- Fees per RVU rose much faster for non-assigning physicians (40 vs. 27 percent); also,
- Fees of assigning physicians were significantly higher in high MDPOP areas, *ceteris paribus*; furthermore,
- Medicare Part B expenditures per capita were positively correlated with average fees, particularly for non-assigning physicians.

While this last relationship may not be strictly causal, it nonetheless emphasizes the importance of constraining physician fees in some way to

arrest Medicare outlays. Also, no evidence is found that physician supplies reduce fees Medicare must pay; in fact, the results suggest the opposite.

Thirteen procedure regressions were run on selected surgical, medical, and diagnostic services. In six of the regressions where MDPOP was significant, it was always positive, especially for pathology tests, office and hospital visits, and tonsillectomies. The first could be taken as evidence in favor of Reinhardt's hypothesis that diagnostic testing may be more inducible, although apparently only for pathology tests (at least of the diagnostics examined).

MDPOP proved to be consistently related in a positive way to all three types of visits: brief and intermediate office, and intermediate hospital. In previous research this anomalous finding has been attributed to either: (a) non-price competition, or (b) greater reduced fees and bad debts, neither of which has been addressed in this study. If physicians in highly competitive areas provide longer visits (which they do) or other important amenities, then interarea charges are not strictly comparable. Whether third parties should be responsible for paying for such amenity-induced differences is certainly arguable. Physicians may also choose to keep stated price artificially high for reimbursement purposes, knowing they will be discounted by both patients and their insurors. While we do not know about patient collection rates, we do know that Blue Shield and Medicare payments are higher in more competitive areas -- as discussed below.

Finally, as in earlier work, GPs per capita were negatively related to fees for four procedures (tonsillectomies, chest x-rays, brief

office visits, and urinalyses), and were positively related for one (Colles fractures).

2. Payments

Physician charges generally are not paid in full by either Blue Shield or Medicare, and it is possible that reimbursement screens used by Pennsylvania Blue Shield could equalize relative charges across areas and specialists. Such, however, is not the case.

Blue Shield/Medicare payments per RVU were about one dollar less than charges on average, a 16 percent reduction. Payment differentials across high and low MDPOP areas were somewhat less than for charges, 9 versus 14 percent, but clearly they had not been eliminated. In 1975, the average charge per RVU was $7.36 in high MDPOP areas while average payments were $6.02, an 18 percent reduction. The corresponding figures for low MDPOP areas were $6.48 and $5.54, a 15 percent reduction.

Rates of reduction differed somewhat by broad specialty group although payments, too, were invariably higher in more physician-dense areas. For GPs and other specialists (e.g., radiologists), the rates of reduction were 14 and 17 percent, respectively, irrespective of geographic areas. For medical and surgical specialists, payments did tend to be relatively less than charges in high MDPOP areas, implying at least an implicit attempt to narrow the fee gap. Payment/fee ratios for these specialists were approximately .85 in low MDPOP areas compared to .80 in high MDPOP areas. Payments in high MDPOP areas were still 5-8 percent above those in low MDPOP areas, however.

Fees and payments per RVU both declined uniformly with physician

work experience, which seems anomalous if there is a positive return to learning-while-practicing -- at least until skills begin to obsolesce Payment/fee ratios for 1978 for selected age cohorts were as follows:

Physician Age Group	Fee per RVU	Payment per RVU	Payment/Fee Ratio
27-38	$9.18	$7.67	.84
39-42	9.09	7.52	.83
47-49	8.68	7.29	.84
50-52	8.71	7.34	.84
60-63	8.34	7.07	.85
64-68	8.02	6.86	.86

Physicians in the youngest decile were charging $9.18/RVU compared to only $8.68 for physicians in the prime working years, age 47-49. Payment reduction rates were more or less constant across age cohorts, which is to be expected given UCR reimbursement based on fees.

Part of the discrepancy may be explained by increasing specialization among younger physicians; but even in fee regressions, fees per RVU exhibited a negative, L-shaped relationship with years of work experience. *Ceteris paribus*, fees fall rapidly across younger physician cohorts, bottoming out in the later years of practice. Thus, simple negative correlation of fees with physician age cannot be completely explained by specialty or procedure mix, cost-of-living differentials, demand factors, or other physician credentials. And although UCR methods of reimbursement do place certain constraints on payments to new market entrants, they apparently are not adequate enough to equalize payment rates across physicians with identical characteristics.

3. Workloads and Intensity

A third area of investigation included physician workloads and intensity of care per patient. Primarily at issue here is the relationship between physician competition, work effort (or productivity), and patterns of care. Neither workloads nor patient intensity uniquely capture physician inducements, for utilization may result not from demand shift, but from a downward movement along an unchanged demand curve as prices fall. The fact that no inverse relationship was found between MDPOP and fees per RVU, on the other hand, allows us to draw stronger conclusions than we otherwise might.

Physician Blue Shield/Medicare workloads (i.e., RVUs/physician) rose 2.3 percent per year compared to 9.1 percent for fees. Medical specialists had the highest workloads, double those of GPs. The relatively low GP workloads are expected, given their lower internalized ancillary care and Blue Shield non-coverage of routine, preventive care.

Workloads exhibited an inverted U-shape with both physician age and MDPOP, being highest for physicians aged 43-49 practicing in areas of medium physician availability. Workloads were lower in both low and high MDPOP areas, which may be attributable to lower Blue Shield penetration in rural areas and a smaller, pro rata demand in urban, physician-dense areas. When other variables like specialty were held constant, however, workloads showed a consistent, negative relationship with MDPOP, which is expected if more physicians are having to compete for relatively fewer patients. Physicians presumably offset some of their lost output by setting higher fees.

An interesting relationship exists between workloads and fees across MDPOP areas. The product of the two gives total Blue Shield/Medicare charges for the 23 procedures. Under simple competitive assumptions (discussed in detail in Chapter II), we would expect both workloads and fees to be lower where physicians are more abundant, yet we already know this to be untrue: workloads are lower (at least in high MDPOP areas), but fees are higher. In most instances the two effects offset each other, resulting in nearly constant total charges per physician, as illustrated below:

	Total Blue Shield/Medicare Charge per Physician		
Specialty	Low MDPOP	Medium MDPOP	High MDPOP
GPs	$ 7,188	$ 7,377	$ 7,050
Medical Specialists	15,603	15,661	15,127
Surgical Specialists	10,134	11,117	10,287
Other Specialists	7,320	12,262	8,544
All Physicians	9,688	10,738	10,657

Only the Other Specialists group shows a broad deviation across areas, due to their relatively high workloads in medium MDPOP areas. Of course, such relationships may be coincidental and Blue Shield penetration and urban/rural demand does vary systematically by market area. Total charges of physicians in low MDPOP areas may be relatively "low" because fewer patients have Blue Shield coverage while workloads in high MDPOP areas are "higher" than expected given a simple prorating of demand because of greater medical need. Still, it is remarkable that the average physician in high MDPOP areas submits bills for essentially the same Blue

Shield/Medicare total amounts even though there are 2.5 times as many physicians per capita as in low MDPOP areas.

Our last area of investigation involved the intensity of care delivered per Blue Shield or Medicare patient seen in any year. Under greater competition, physicians would be expected to have to "share" patients more in terms of referrals and services delivered, as well as simply seeing fewer of them. They may try to compensate for this competitive sharing effect by recommending more intensive care (e.g., more hospital and office visits, more lab tests, more x-rays).

A real problem in analyzing intensity over time is presented by non-repetitive surgery, which imparts a downward bias to all intensity measures where it is included. Only limited statements about inducement can be made given this caveat. For example, both tonsillectomies and lens excisions declined rapidly as a percent of patients seen for our physician panel, yet fees rose much more rapidly for the former, non-repetitive procedure. While absolute demand for tonsillectomies has been falling nationwide, it has not been falling for lens excisions. Any one physician group, however, will show a declining excision rate as they perform the procedure on a shrinking number of candidates unless offset by new patients. In Pennsylvania, the number of elderly which form the primary pool for lens excision grew far faster than the number of ophthalmologists, actually resulting in an almost constant eligible pool. Adjusting for this gives a nearly constant surgery rate, thereby reducing physician pressures to raise fees to offset declining demands -- as hypothesized to be the case with tonsillectomies.

Trends in intensity were generally negative, reflecting the

dominance of non-repetitive surgery, with a few important exceptions. Intensity actually increased for general surgeons and other specialists practicing in high MDPOP areas. As other specialists like pathologists and radiologists perform non-repetitive services for the most part, it is not too surprising that their intensity rose, particularly as they depend upon referrals from many other specialties; but why intensity per patient seen would rise for surgeons is quite unexpected in light of the strong downward bias in the measure for this group. One explanation might be that in surgeon-dense areas, general surgeons have an increasing tendency to practice like GPs and internists, with many more office visits and ancillaries. A less sanguine interpretation would suggest that they perform more unnecessary, elective surgery (e.g., tonsillectomies, herniorrhaphies) to maintain target incomes. Only a much more detailed investigation of their practice patterns across market areas could discriminate between the two hypotheses.

Most of the ancillary tests showed positive trends in intensity, headed by complete blood count and urinalyses at 4.1 and 3.2 percent annually, respectively. Upper GIs and EKGs actually had slight declines. Ancillary intensity was much higher in high MDPOP areas than elsewhere: chest x-rays (28 percent of patients seen in low MDPOP areas versus 36 percent in high MDPOP areas); EKGs (31 versus 51 percent); and urinalyses (31 versus 46 percent). How much of this discrepancy is attributable to greater internalization of production in high MDPOP areas is unknown, but it is unlikely to account for such wide disparities. Nor can the difference be attributable to specialty mix, as ancillary intensity rates were similar within specialty.

D. OVERVIEW OF STUDY

The next section provides a general theory of demand creation, or inducement based on area markets for physician services. The theory is then respecified in terms of individual physicians who form the unit of analysis in this study. Section III summarizes in detail the Pennsylvania Blue Shield data base developed for this study and provides a list of the dependent and independent variables. Sections IV and V present findings, first in descriptive, then in econometric form.

II. ANALYTIC FRAMEWORK

A. GENERAL THEORY OF DEMAND CREATION

The issue of physician-induced demand can be analyzed most simply in terms of supply and demand. Much confusion exists between "price induced" and "supply (or physician) induced" increases in utilization. Figure 1 depicts the total demand (D) for and Supply (S) of some type of physician service (e.g., office visits, operations) in a market area. Each curve represents the horizontal summation of individual physician demand and supply curves.[1] If area population increased, total demand would area shift to the right. The same would happen to supply with an influx of physicians. Demand is downward-sloping, indicating that patients will use more physician services at lower prices. Supply is positively sloped as physicians are hypothesized to be willing to supply more services (e.g., office visits) at higher prices. Given demand, D_0, and supply, S_0, competition should lead to a market equilibrium at point A with price P_e and utilization rate Q_e (e.g., office visits per 100,000 population in the area).

An increased number of physicians in an area, holding population constant, would shift out supply (i.e., $MDPOP_1 > MDPOP_0$). If demand were unchanged, price should fall along the demand schedule to a new equilibrium at B with P_1 and Q_1. Thus, we should observe a positive

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1. Whether there is such a thing as physician supply curves in a monopolistic market is arguable, a point we return to later. On this point, see in particular, Yett (1980).

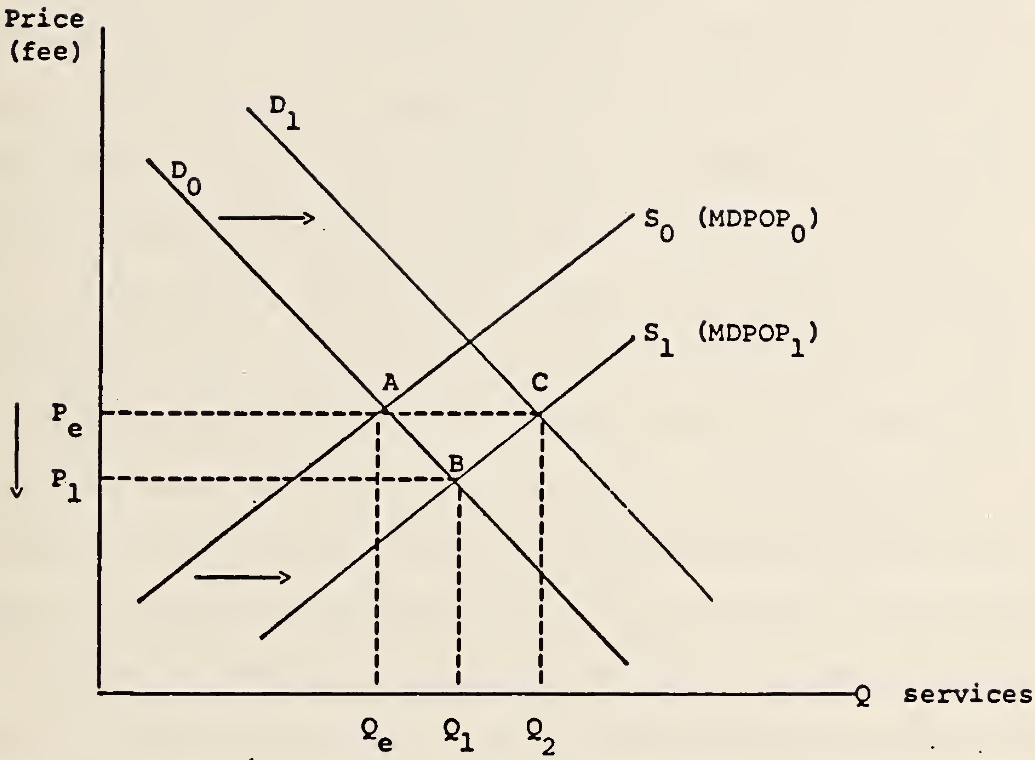

FIGURE 1

A Simple Model of Demand Creation

correlation between the physician-population ratio (MDPOP) and the utilization rate, Q, but this is due to price inducement alone. No physician inducement has occurred. But if providers, singly or jointly, are dissatisfied with the new price, P_1, they may shift the entire demand curve outward, provided they have the economic power to do so. If demand were shifted to D_1, say, the price would not fall but would remain at P_e. Quantity, however, would increase even further to Q_2. In this case we would observe no correlation between price and MDPOP and a very strong positive correlation between utilization and MDPOP. The quantity, $Q_2 - Q_1$, reflects the increase in utilization due solely to physician inducement while $Q_1 - Q_e$ represents "legitimate" price induced output.

The trick is to somehow tell whether we are observing point B or point C when physician supply varies spatially or intertemporally. In fact this would be relatively easy by simply comparing price-quantity changes. If prices are unchanged and quantity increases, shifting must have occurred, holding all other demand and supply variables constant, a caveat we return to in a moment. What complicates the analysis is that inducement, if it exists, may not leave equilibrium price unchanged. We could be observing price-quantity combinations anywhere above point B, depending on where the induced demand curve intersected supply. If this is between B and C, then we observe lower prices and higher quantities, an observation fully consistent with the no inducement hypothesis. Only if equilibrium came above C, with higher prices, would we be certain of inducement.[2]

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2. For a formal mathematical proof, see Reinhardt (1978).

Or would we? Demand and supply are functions of price and a number of other variables, all of which must be held constant for our simple conclusions to hold. If MDPOP is correlated with other exogenous demand or supply variables, any discovered inducement effects may be wrongly ascribed to differences in MDPOP. Suppose, for example, that physicians tended to locate in wealthier areas. If higher income leads to a greater demand for physicians' services, then D_1 would not necessarily reflect inducement: physicians would only be responding to a stronger demand. To determine whether the intersection of demand and supply includes any inducement, we must be able to hold all relevant demand and supply factors constant, then look at prices. If prices go up as MDPOP rises, then this is strong _prima facie_ evidence of inducement. Looking at utilization is trickier because changes in Q include both legitimate price and illegitimate nonprice influences. We would have to have further information on any price changes before "proving" the existence of demand inducement from utilization changes. In fact, prices and all other exogenous factors would have to remain unchanged for quantity (per capita) increases to categorically support the inducement hypothesis (represented by a movement from A to C in Figure 1). Even a small price decline could explain all of the utilization increase if demand were highly price elastic, an admittedly unlikely proposition but one that cannot be dismissed out-of-hand.

B. A PHYSICIAN-SPECIFIC INDUCEMENT MODEL

Our data base provides a wealth of information at the individual practice level, suggesting a respecification of the inducement theory with the physician as the unit of analysis. Demand, D_0, can be considered as the horizontal summation of individual physician demand in <u>pro rata</u> fashion, as shown in Figure 2. At any price, P_e, the monopolistically competitive quantity demanded, A, for the average physician, is equal to total market quantity, B, divided by MD, the number of physicians, i.e., A = D/MD at P_e. (The analysis can also be expressed in per capita terms by simply dividing D and MD by area population.)

In the physician market we assume individual physicians face downward-sloping demands rather than the perfectly competitive, horizontal demand, but peer competition does not allow each to set price and quantity as pure monopolists either. If, for example, a typical physician lowered his fee below P_e, he would "capture" more patients than predicted by a simple downward movement along his <u>pro rata</u> demand curve, D_0/MD (or the ratio of D_0/POP to MD/POP). Curve d presumes that other physicians, of course, are not altering their prices, an unrealistic assumption. When others lower fees in response to a loss of patients, assuming no inducement for the moment, average prices fall and overall market demand does increase, not along d for each physician, but along the <u>pro rata</u> demand curve. Eventually, d shifts down and an equilibrium fee-quantity is found along each physician's <u>pro rata</u> demand that is also consistent with market demand. For simplicity, let us consider this point A.

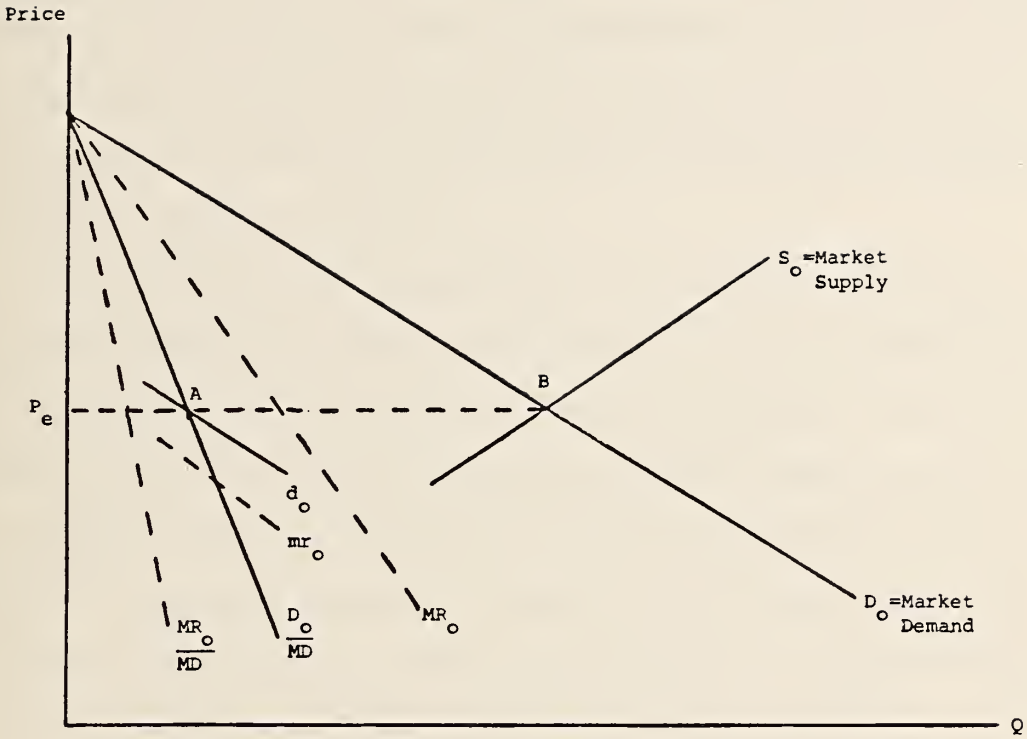

FIGURE 2

Monopolistically Competitive Model
of Physician Demand

Hence, the conclusion that prices are lower and output higher than under pure monopoly.

For a constant market demand, an influx of physicians should rotate pro rata demand inward and shift the more elastic d curve downward (or inward) as well, as physicians (theoretically) react to increased competition and loss of patients by lowering fees.[3] Thus, we should expect a negative correlation between average physician fees and per capita supplies although workloads may well be greater (the aforementioned price-induced effect on output).

With inducement, the conclusions are not nearly so clear-cut. Individual physicians, unhappy with lower fees, may induce additional visits, operations, etc., thereby offsetting the inward rotation in demand. This has the effect of rotating aggregate demand outwards as well. Whether they are successful at completely offsetting natural competitive pressures on fees is an empirical question. If they are, then no inverse correlation would exist between supply (or number of practicing physicians) and average fees.

All of these arguments ignore factors other than the number of physicians in influencing demand. Clearly, any factor that influences demand or is correlated with physician supply must be held constant to avoid spurious correlations. Possible factors can be grouped into

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3. Hirshleifer (1980) notes that more suppliers can result in an outward shift in market, and hence, pro rata demand due to greater consumer accessibility. This point is often made in the physician market in terms of lower time prices (Pauly, 1980). Yet, as Hirshleifer points out, the net change in pro rata demand still should be inward as the denominator, MDPOP, grows more rapidly than the numerator, per capita demand.

area-specific vs. *physician-specific*. Area-specific factors would include the usual demand variables like income and insurance coverage and proxies like unemployment rates, poverty families, and Medicare/Medicaid coverage. Also relevant would be proxies for medical need and use of medical inputs. Included in this category would be such things as schooling levels, degree of urbanization (to capture differences in accident rates, etc.), and demographic mix (under 5 years of age, over 65, percent female or minority).

Individual physician characteristics should also affect *pro rata* shares of aggregate demand. Board certified M.D.s, for example, should be able to command higher fees than less trained physicians. Specialists should also enjoy stronger demand than general practitioners. Physician age should exhibit an inverted U-shaped relationship with demand (or fees) as middle-aged physicians enjoy returns to greater experience which are eventually offset by skill obsolescence (both real and perceived). Finally, physicians as a group should charge higher fees when operating in more expensive labor markets.

C. STATIC AND DYNAMIC REDUCTIONS

Across physician market areas at any point in time, neoclassical theory predicts an inverse correlation between physician fees and supplies, *ceteris paribus*. This is certainly true under perfect competition and profit maximization and should also obtain under monopolistic competition as well. If physicians are utility maximizers, backward-bending supply curves are possible, with higher fees and much

less output per physician, but this behavior is antithetical to neoclassical, positively sloped supply curves. Furthermore, as utility maximizers, physicians should be less inclined to induce demand for services requiring more of their time, a fact pointed out by Reinhardt (1978). This leads to a more specific prediction that lab tests, EKGs, and other procedures requiring less physician input should be more inducible than surgical procedures and comprehensive hospital and office visits. In other words, the less involved the physician is in a direct way in providing a service, the more inducible it becomes in his eyes, and hence the less likely we should be to observe an inverse correlation between fees and physician supplies, _ceteris paribus_.

Dynamic predictions of inducement over time are less direct, as much depends on holding constant secular trends in demand and supply. In general, however, we would expect a slower rate of fee inflation in physician-dense areas because of greater price competition. While supply in such areas may be more price-inelastic so that intertemporal demand shifts result in higher-than-average fee inflation, no strong reason argues for this scenario, especially within specialty group for a particular procedure. If, on the other hand, physicians successfully induce demand for some procedures to keep up with inflation, then no inverse correlation between fee inflation and physician competition would be observed.

III. PBS DATA BASE AND VARIABLE SPECIFICATION

A. LONGITUDINAL CLAIMS FILE

The basic data base for this study is taken from Pennsylvania Blue Shield files of submitted claims for physician services, aggregated and supplemented in certain ways to form a cross-section of time-series on individual physicians for the six-year period, 1973-1978. As these files include literally millions of separate claims per year, various criteria were used in abstracting the data to produce manageable analytic files. The physician-year was the unit of analysis, giving 48,594 observations *in toto*, 8,099 physicians for each of six years.

B. SCOPE AND CRITERIA FOR INCLUSION

The sample of physicians and claims was limited following a two step procedure. First, as part of a related cross-sectional study, a list of 44 regular Blue Shield business and 33 Medicare Part B procedures had been chosen for examination and all claims pertaining to these procedures were aggregated by physician for 1975. This list accounted for roughly one-half of all Blue Shield services and over 70 percent of all Medicare services. To insure stable estimates of charges and utilization, physicians were required to have submitted at least ten claims for a particular procedure during the year or else all their claims data were dropped, but only for that procedure subfile.

Using the 1975 physician sample as a starting point, longitudinal files were constructed by physician for each of 23 procedures (described in detail below) by adding claims for the years 1973, 74, 76, 77 and 78. If, for a given procedure, the physician did not bill at least once during each and every year before and after 1975, he was dropped. This insured a sample of established physicians with continuous billing over the six year period, with at least ten claims submitted for a given procedure in 1975.

Because some physicians do not perform certain procedures, or at least not often enough to meet the above criteria, the physician sample varies by procedure (Table 3-1), from a high of 5,564 for brief office visit to a low of 30 for laminotomy (herniated disc). This selection process resulted in 8,099 unique physicians across the 23 procedures.

Due to difficulties in matching demographic data for practice locations which change from year to year, physicians who moved across counties during the six-year period or who perform different procedures in different counties were dropped. This reduced the sample of physicians represented in any procedure file by an additional 2.2 to 4.4 percent. All physicians remaining in the 23 procedure files practiced continuously in a single county for all six years.

C. ANALYTIC PROCEDURE AND SUMMARY FILES

Twenty-four analytic longitudinal files were constructed: 23 individual procedure files plus a summary file which aggregates charge and utilization information by physician across the 23 separate files. Each file contains basic physician charge and utilization information pertinent

TABLE 3-1. LONGITUDINAL STUDY FILES:
PROCEDURES, NUMBER OF PHYSICIANS, AND RELATIVE VALUES

	PHYSICIANS			
	Total	Regular Business	Medicare	Relative Value
Colles fracture, closed reduction	122	115	34	17.60
Tonsillectomy, child	133	133	0	16.51
Protosigmoidoscopy	781	649	598	3.17
Cholecystectomy	177	169	46	54.23
Herniorrhaphy, inguinal	216	168	112	34.88
Resection prostate, transurethal	148	60	146	68.32
D&C	224	223	5	15.84
Hysterectomy, total	207	207	2	60.12
Laminotomy for herniated disc	30	29	4	84.76
Excision of lens, unilateral	242	66	242	66.44
Delivery, vaginal, incl. pre/post	424	424	0	40.33
Chest X-ray, PA & lateral	304	247	257	2.51
Upper GI	141	120	110	5.30
Brief office visit	5564	29	5564	1.00
Intermediate office visit	3808	50	3791	1.28
Initial hospital visit with comprehensive workup	3196	2584	2670	4.60
Brief hospital visit	1955	1341	1644	1.08
Intermediate hospital visit	3005	2317	2635	1.46
EKG w/interpretation	2033	1709	1773	2.51
Urinalysis	1434	418	1378	0.41
Fasting blood sugar	1632	666	1582	0.56
Complete blood count	1134	627	1023	0.70
Comprehensive consultation	1823	1340	1611	5.31

to that procedure, viz., average median charge, number of times service was provided, plus other physician-specific and county-of-practice information (described below). Table 3-1 provides a list of the 23 procedures along with the number of physicians by line of business. The total number of physicians in any file is less than the sum of physicians in each of the two lines of business separately because of physicians who see both kinds of insured patients. Also, because the physician-year is the actual unit of observation, the total number of observations in any file is exactly six times the total number of physicians in the last column.

As may be imagined, many of these files are quite large. The brief office visit file, for example, has over 33,000 separate records, composed almost exclusively of physicians seeing Medicare patients (PBS does not cover this particular kind of visit). Many other visit categories have over 10,000 observations, including office visit (22,848), initial hospital visit (19,176), and intermediate hospital visit (18,030).

The 23 procedures chosen for longitudinal analysis form a subset of the 44 topic procedures selected for a parallel 1975 cross-sectional study. Criteria for procedure selection in the cross-sectional experience sample required that;

(1) procedure definition and description be unambiguous and generally accepted;

(2) enough observations exist to provide adequate sample sizes;

(3) when possible, the procedure be performed across a large number of specialties (not always the case);

(4) procedures be reasonably representative of the mix of service categories reported.

To these criteria was added a fifth that:

(5) procedures also represent a mix in terms of the physician's ability and willingness to induce demand.

Not all services are amenable to shifting. Initial office visits and a large number of surgical procedures are either of an emergency nature or are at the patient's initiation. As a result, any inducement effect can be overwhelmed by the majority of services which cannot be increased arbitrarily.

If one can make *a priori* predictions as to the services most conducive to shifting, then a sharper test of the inducement hypothesis is possible. Physicians produce a broad range of medical and surgical services. While surgery in general is presumably less amenable to demand inducement, certain surgical procedures like tonsillectomy, herniorrhaphy, and D&C tend to be more elective and thereby potentially more inducible. Fractures and obstetrical deliveries probably are at the opposite end of the spectrum and can be used as "controls" against which to compare surgical inducement. That is, if inducement exists, we should find a greater effect the more elective the surgery.

Other procedures can be similarly fitted along a discretionary continuum. Initial hospital visits, for example, should be less inducible than follow-up hospital visits which are more discretionary. Ancillary services of all kinds are likely to be highly inducible, particularly given the small amount of physician input involved (Reinhardt, 1978). Of the extensive list of possible choices, six ancillaries have been chosen: chest x-ray, upper GI series, EKG, urinalysis, blood sugar, and a complete blood count. A comprehensive consultation was included to test for

inducement effects through physician referrals.

The longitudinal summary file aggregates physician fee and utilization information across the individual procedures using relative charges and utilization as weights. Total procedure output per physician-year was calculated as the weighted sum of each of 23 services, the weights based on empirical pricing data from the 1975 PBS Medicare and Blue Shield claims experience. A mean billed charge per procedure was determined, then scaled to the average fee for a brief office visit. This RVU-like scale is provided in column (4), Table 3-1 above. Based on the relative prices, an upper GI series is valued at 5.3 times a brief office visit, an EKG, 2.51; a complete blood count, .7; while various surgical procedures range from 3.17 for a proctosigmoidoscopy to 84.76 for a laminotomy for a herniated disc. Using constant 1975 weights derived from the entire sample eliminates both physician and time effects on the prices weights.

A physician summary charge index was derived in a similar manner by multiplying median charge per procedure times frequency, giving an estimate of gross revenues, then dividing by weighted output. The resulting "price" reflects the average charge per RVU.

Quantity and price indexes were calculated, first, for Blue Shield and Medicare separately, then combined using physician relative output in the two programs as weights. Aggregated Blue Shield and Medicare Level I and II screens, payments, and participation rates were similarly indexed and weighted across the 23 procedures, putting all dollars and percents in RVU terms.

D. CHARGE, UTILIZATION, AND EXPLANATORY VARIABLES

Each of the 24 analytic files contains information on physician billings, utilization, and payments, plus physician-specific characteristics taken from the American Medical Directory and PBS provider files, and certain county characteristics having to do with patient demand and medical care supply. Table 3-2 provides a list of all variables on each file by category. Sources for all data can be found in PBS Research Report R-419-10 (October, 1979).

The FEE variable on the individual procedure files is the weighted average of Blue Shield and Medicare median charges, the weights being the relative number of line items billed to Blue Shield and Medicare. FEE and other charge, payment, and utilization variables were aggregated across the 23 procedure files in the summary file in the manner described in the previous section.

Deflation of fees, payments, and all other dollar variables on the files was done using an estimated county-level Consumer Price Index (CPI). County CPI figures do not exist and had to be estimated based on CPI data available for selected SMSAs. Using a specification provided by Gabel at HCFA, 1975 CPI data for eight regional SMSAs in, or proximate to, Pennsylvania (Baltimore, Buffalo, Cincinnati, Cleveland, Scranton, New York, Philadelphia, and Pittsburgh) were regressed on five predictors: population density, per capita income, median housing values, average rental rates, and percent of population living in urban areas. The resulting equation was then used to predict county-level CPIs based on county-specific information on the predictors. For 1975, the index

TABLE 3-2. CHARGE, PAYMENT, UTILIZATION, AND EXPLANATORY VARIABLES

Mnemonic	Category and Description
	Charge/Payments
FEE, AFFE	Average median charge, nominal and deflated by CPI
MDNCHG, MDNPAY	Blue Shield median charge, payment
MNLEV1, MNLEV2	Blue Shield Level I, Level II screens
PCTUCR	Pct. Blue Shield line items under UCR
MMDNCHG, MMDNPAY	Medicare median charge, payment
MMNLEVI, MMNLEV2	Medicare Level I (customary), II (prevailing) screens
PCTASN	Pct. Medicare line items assigned
CHGUCR, LIUCR, PAYUCR	Pct. of Blue Shield-plus-Medicare charges, line items, and payments under UCR
CHGASN, LIASN, ALLASN	Pct. of Blue Shield-plus-Medicare charges, line items, and payments assigned or billed as payment-in-full
BSTOTREV, MBTOTREV	Blue Shield, Medicare total revenues (payments)
	Utilization
TOTSVCS, MTOTSVCS, TOTS	Blue Shield, Medicare, and total services billed
BSPTS, MBPTS	Blue Shield, Medicare patients
UABS, URM, URT	Blue Shield, Medicare, and total patient utilization rate
	Metro/County Characteristics
POP	Total county population
POPURB, POPMINOR, POPFEM, POPLT5, POPGT65, POPPOV	Pct. of population living in urban areas, minority, female, under five years old, over age 65, and under poverty level
POPDENSE	Population density per square mile
SCHYRS	Median school years completed
WORKUNEM, WORKLAB	Pct. of workforce unemployed; pct. laborers
PCINC, ADJPCINC	Per capita income, nominal and deflated by CPI
HOSPBDS	Hospital beds per 100,000 population
PHYHOSP	Pct. of physicians hospital-based

TABLE 3-2. CHARGE, PAYMENT, UTILIZATION, AND EXPLANATORY VARIABLES

(Continued)

Mnemonic	Category and Description
	Metro/County Characteristics
PCTAREPR, MDSPER, SURGPER, GPPER	Direct patient care physicians, medical and surgical specialists, general practitioners per 100,000
METRODRS	Direct patient care physicians per 100,000 in metro area
PTCAREMI, PTCPERMI	Direct patient care physicians per 100 square miles, and per 100,000 per 100 square miles
DROFFWAG, ADJDRWAG	Average annual salary per physician employee, nominal and deflated by CPI
BSTOTPAY, MEDALLW, MEDASST	Total Blue Shield, Medicare payments in county, state medical payments per capita
ADJMEDAS, ADJMEDB	State medical assistance, Medicare payments per capita, deflated by CPI
CPI	County level consumer price index
RENT, HOUSE	Average housing rental rate, median housing value
	Physician Characteristics
DRNO	Unique physician number
COUNTY, ZIP, METRO	County, ZIP code, and metro area of practice
LOB	Line of business (Blue Shield, Medicare, both)
DEGREE	M.D. or D.O.
PBSSPEC, BRDSPEC	PBS self-designated specialty, broad specialty group
BOARD	Specialty certification (yes/no)
PROFSCHL	Medical School attended
AGE, YRSLIC	Physician age, number of years licensed (in 1975)
PARTSTAT	Blue Shield participation status

ranged from a low of 102 in rural Pike county to a high of 121 in Philadelphia, conforming fairly well to expectations of urban/rural cost-of-living differences. Because no time-series data were used in the original estimation, the index is essentially cross-sectional, except for any time-dependent changes in the predictors. The mean value of the index rose only three points (from 109 to 112) over six years. Hence any deflation of statistics using the index really only applies geographically and not intertemporally. In other words, trends over time in "deflated" fees do not reflect changes in real charges from one period to the next. This should not be a major problem for this study given the focus on geographic differences in fees, utilization, and physician competition.

Most of the charge, payment, and utilization variables in Table 3-2 are straightforward. The Level I and II screens reflect the two limits placed on individual physician charges under UCR reimbursement schemes: usual (Blue Shield) or customary (Medicare) for Level I; customary (Blue Shield) or prevailing (Medicare) for Level II. Utilization rates were calculated on a per patient basis by dividing total services provided by a physician by the total number of unique patients seen during the year. Thus, we have output per physician as well as utilization per patient.

Using the actual county of practice, physicians' data have been grouped into 13 METRO-NONMETRO areas to more properly reflect market areas and reduce the bordercrossing problem: Wilkes-Barre, Scranton, Altoona, Erie, Johnstown, Reading, Harrisburg, York, Lancaster, Allentown-Bethlehem-Easton, Pittsburgh, Philadelphia, and other (rural) counties. Physician-population and other county variables were then put on a metro area basis. Broad specialty group is an aggregation of 37

specific individually represented specialties into the following four broad classes: general practitioners (including family practice), medical specialists, surgical specialists, other specialties.

E. STRENGTHS AND WEAKNESSES OF DATA BASE

The great strengths of our data base are its comprehensiveness and accuracy. All included physicians were in continuous practice across all six years. Utilization and fees are based on all claims submitted for a significant percentage of the physician's practice. The data are based on actual services and not physician self-reports, and have been adjusted for geographic differences in living and operating costs. A number of key physician descriptors have also been added to adjust for differences in the quality and type of care received. Finally, many county demand and supply variables have been merged in order to adjust for geographic differences in medical need and alternative sources of care.

Certain drawbacks exist, however, in testing for physician inducement. First, only data on the Blue Shield and Medicare portion of the physician's practice are available. If these two are relatively minor for a particular physician, then the estimated price and utilization rate statistics may not be representative. While for some physicians this may indeed be true, it is unlikely to be so for the bulk of our sample -- particularly given the minimum billing requirement of at least ten services in 1975. Second, no data exist on practice amenities, e.g., length of visit, waiting times, that can influence demand and bias our findings in favor of inducement. How important such variables really are

in physician pricing (and demand) is still debatable, however (see Sloan and Feldman, 1978; Sloan, September, 1979). Third, reported charges may not necessarily reflect final transaction prices. Physicians may not collect the full deductible and coinsurance from Blue Shield or Medicare patients. If their discounts and bad debts increase with competition, then stated prices will be systematically higher than transaction prices in physician-dense areas. It is not known how serious a problem this is.

IV. DESCRIPTIVE FINDINGS

A. ORGANIZATION OF CHAPTER

Descriptive information on physician submitted charges, services, and payments are presented, first on an aggregated basis and then by individual procedure. All payment information has been deflated for geographic differences in costs-of-living, although no intertemporal deflator has been used due to the lack of a county-specific CPI on an annual basis. Utilization information is presented both on a per physician and a per patient seen basis, the latter reflecting intensity per beneficiary.

Much of the comparative data is displayed by low, medium, and high physician-population groups. Categorizing physicians by degree of area competition was done in two steps. First the 67 Pennsylvania counties were grouped into 13 metro areas, 12 urban and one rural, to reflect market areas and reduce the bordercrossing problems. Direct patient care physician-population ratios were then calculated for each area in 1975 and the areas designated high, medium, or low in roughly equal proportions. Thus, urban areas like Philadelphia with 241 physicians per 100,000 were categorized as high physician density, while all rural areas (with only 96 physicians per 100,000) were classified as low. This categorization, while only crudely approximating individual physician competitive markets, should allow some useful comparisons of a descriptive nature on the relation between fees, utilization, and competition.

B. PHYSICIAN WORKLOADS AND CHARGES BY GEOGRAPHIC AREA

Table 4-1 displays annual physician workloads, defined as weighted averages of 23 Blue Shield and Medicare services, along with weighted fees per RVU, first for the 13 metro/nonmetro areas, then by low, medium, and high physician/population (MDPOP) groupings. Metro areas are ranked by the number of direct patient care physicians per 100,000. The ranking is closely related to SMSA size, with Philadelphia, Harrisburg, and Pittsburgh at the top.

Average physician Blue Shield plus Medicare workloads in 1978 were 1,770 RVU units for the 23 procedures taken as a whole, up from 1,591 in 1973, an increase of 2.25 percent per annum. Average deflated fees per RVU were $8.60 in 1978, up from $5.92 in 1973, a growth rate of 9.1 per year, or four times as fast as workloads.

Holding Blue Shield and Medicare penetration constant, one would expect average workloads to fall with greater physician concentration as *pro rata* demand shifts in. This does not seem to be the case as can be seen at the bottom of the table. Workloads in low and high MDPOP areas are quite similar, yet 400 or so units less than for physicians in areas of medium physician concentration. Physicians practicing in the Pittsburgh, Reading, and Scranton metro areas have particularly high workloads given the relative supply of physicians. Blue Shield penetration clearly does vary by market area, however, giving widely different Blue Shield enrollees per physician (E/MD), as shown in the last column of Table 4-1. Reading, Scranton, and Wilkes-Barre all have

TABLE 4-1. AVERAGE PHYSICIAN BLUE SHIELD-PLUS-MEDICARE WORKLOADS AND FEES, DEFLATED,

BY METRO AREA BY DEGREE OF PHYSICIAN CONCENTRATION

AREA	DIRECT PATIENT PER 100,000 CARE MDS	WTOTS				WAFEE				E/MD
		1973	1976	1978	ANNUAL % Δ	1973	1976	1978	ANNUAL % Δ	
ALL AREAS	170	1591	1863	1770	2.25%	5.92	7.46	8.60	9.1%	398
1. Philadelphia	241	1498	1748	1624	1.68	6.33	8.00	9.19	9.0	211
2. Harrisburg	174	1520	1807	1689	2.22	5.57	7.17	8.15	9.3	339
3. Pittsburgh	162	1952	2342	2241	2.96	5.73	7.13	8.33	9.1	395
4. Allentown-Beth-Easton	128	1590	1823	1710	1.51	5.66	7.24	8.41	9.7	578
5. Reading	128	1910	2179	2101	2.00	5.73	7.03	8.08	8.2	430
6. Altoona	111	1090	1452	1447	6.55	5.32	6.52	7.53	8.3	207
7. Scranton	111	1760	2110	1929	1.92	6.00	7.54	8.76	9.2	495
8. Erie	99	1063	1368	1308	4.61	5.64	7.37	8.48	10.1	485
9. Johnstown	99	2010	2097	2086	0.76	6.29	7.75	8.75	7.8	384
10. Lancaster	96	912	1099	1075	3.57	5.15	6.56	7.58	9.4	167
11. York	93	1050	1221	1234	3.50	5.50	6.91	7.97	9.0	430
12. Wilkes-Barre	91	1846	2180	2148	7.00	5.56	7.09	8.11	9.2	648
13. Rural	86	1567	1789	1756	2.41	5.58	6.97	8.07	8.9	407
LOW MDPOP	< 111	1482	1720	1680	2.67	5.60	7.04	8.13	9.0	
MEDIUM MDPOP	111 - 174	1826	2163	2060	2.56	5.70	7.15	8.30	9.1	
HIGH MDPOP	> 174	1498	1748	1624	1.68	6.33	8.00	9.19	9.0	

high numbers of enrollees per physician, explaining some of the workload differences. Yet, Pittsburgh, which shows very high physician workloads, does not exhibit a particularly high E/MD ratio.

Even after deflating by the cost-of-living, Philadelphia still exhibits the highest physician charge per RVU, $9.19 in 1978. In fact, deflated fees do appear to be positively correlated with physician concentration rather than the opposite. Many uncontrolled variables could explain this relationship, including specialty mix, insurance coverage, and demographics; yet the correlation is striking -- particularly after deflation and adjustments for more complex types of procedures. Trends in fees show no relationship to physician supplies either, rising 9.0 percent per year, suggesting that greater competition does not necessarily narrow differentials over time. Again, however, care must be taken in interpreting these figures due to the possibility of confounding variables.

C. CHARGES, UTILIZATION RATES, AND WORKLOADS BY PHYSICIAN CHARACTERISTIC

Table 4-2 next presents charges, utilization, and workloads for 1975 by selected physician characteristics for low, medium, and high physician density areas. Like the previous table, all statistics are taken from the longitudinal summary file which uses a relative value scale to aggregate charges and services across 23 procedures (as described in Section IV.B above). For example, general practitioners practicing in low physician/population areas in 1975 produced 1,206 weighted Blue Shield and Medicare services at an average charge of $5.96 per RVU. They were paid

TABLE 4-2. WEIGHTED CHARGES, PAYMENTS, WORKLOADS, AND UTILIZATION RATES

BY PRACTICE CHARACTERISTIC BY PHYSICIAN DENSITY, 1975

PHYSICIAN CHARACTERISTIC	WTOTS LO	WTOTS MED	WTOTS HI	WURT LO	WURT MED	WURT HI	WAFEE LO	WAFEE MED	WAFEE HI	WAPAY LO	WAPAY MED	WAPAY HI
SPECIALTY												
GPs	1206	1116	1078	6.36	5.79	5.95	$5.96	$6.60	$6.54	$5.18	$5.26	$5.62
MED. SPEC.	2258	2310	1993	6.87	6.18	6.46	6.91	6.78	7.59	5.87	5.86	6.16
SURG. SPEC.	1473	1586	1294	4.91	4.66	4.27	6.88	7.01	7.95	5.81	5.92	6.26
OTHER SPEC.	1031	1727	1111	2.88	3.26	3.01	7.10	7.10	7.69	5.90	6.26	6.45
BOARD CERTIFIED												
NO	1285	1454	1252	6.18	6.02	6.15	6.24	6.34	6.83	5.41	5.53	5.80
YES	1909	1834	1654	5.35	4.73	4.80	6.94	6.92	7.92	5.79	5.86	6.26
LINE OF BUSINESS												
BS ONLY	1556	1529	850	6.39	5.70	5.57	7.01	6.43	7.35	5.95	5.50	5.46
MEDICARE ONLY	584	550	588	4.33	4.12	4.20	6.55	6.85	7.36	5.58	5.93	6.29
BS & MEDICARE	2473	3277	2629	6.88	6.37	6.36	6.41	6.52	7.43	5.50	5.58	5.93
MD AGE												
27 - 42	1647	1694	1489	5.52	5.10	4.97	6.98	6.99	7.72	5.95	5.99	6.22
43 - 49	1824	1951	1568	6.08	5.40	5.57	6.49	6.74	7.54	5.50	5.68	6.10
50 - 56	1615	1832	1583	5.88	5.49	5.41	6.49	6.58	7.46	5.52	5.64	6.00
57 - 63	1466	1594	1352	5.99	5.65	5.48	6.31	6.32	7.17	5.44	5.55	5.87
64 +	979	1014	1242	6.00	5.48	6.10	6.13	6.37	6.88	5.30	5.55	5.90
AVERAGE	1495	1627	1448	5.90	5.44	5.49	6.48	6.60	7.36	5.54	5.68	6.02

NOTES:

WTOTS = Weighted Total Services per physician
WURT = Weighted Utilization Rate per patient seen
WAFEE = Average Total Charge per RVU, COL deflated
WAPAY = Average Blue Shield or Medicare payment per RVU, COL deflated

about 13 percent less, or $5.18 per weighted unit of service. Weighted utilization per patient seen was 6.36 units of service, or slightly over six brief office visits per year. It should be remembered, however, that Blue Shield does not generally cover brief office visits, which results in a significantly lower estimate of actual physician workloads and a corresponding upward estimate of the intensity of care per patient seen. To reduce biases this might introduce, comparisons are made by specialty and line of business (LOB) as well.

Medical specialists clearly have the highest average Blue Shield/ Medicare workloads -- nearly double those of general practitioners. This is primarily due to the greater number of ancillaries billed for and the more complex visit mix. GPs, moreover, rely more heavily on brief office visits which Blue Shield usually does not cover. Surgical specialists are only 20-30 percent more productive than GPs, which is somewhat surprising considering the higher proportion of more intensive surgical procedures covered by Blue Shield. (A herniorraphy, for example, is "worth" 35 brief office visits.) Board certified physicians also bill for more services, which is consistent with the lower workloads of non-certified GPs. Physicians seeing both Blue Shield and Medicare patients naturally bill at much higher levels. That Blue Shield-only physicians have considerably higher workloads than Medicare-only physicians can be explained by inclusion of OB-GYNs in the former and the greater number of Blue Shield patients in any market area. Finally, Blue Shield/Medicare workloads follow an inverted U-shaped pattern with physician age, or with physician work experience, peaking between the ages of 43 and 49 and falling thereafter.

No monotonic relationship is found between Blue Shield/Medicare workloads and physician density either. Overall workloads are 1,495 RVUs in low MDPOP areas, rising to 1,627 in areas of medium competition, and then actually falling again in high density areas. This pattern is generally consistent within specialty group, except for GPs where workloads uniformly decline with more direct patient care physicians. This again could be due to a systematic variation in Blue Shield market penetration.

Turning to charges and payments, surgeons and "other" specialists, including psychiatrists, radiologists, and pathologists, show the highest charges per RVU, followed by medical specialists, with GPs exhibiting the lowest average charges per RVU ($5.96 - $6.54). Board certified physicians also show considerably higher charges per RVU, 10 percent higher on average, again consistent with the lower GP charges.

One interesting finding is the negative relationship between charges and physician age. We might have expected charges, like workloads, to rise at first as the physician gains on-the-job training and a referral network, but eventually falling as skills obsolesce with advancing age. An even finer breakdown (see Table 4-3) of the relationship into age deciles, however, still shows the same phenomenon: physicians in the younger deciles uniformly show the highest charges. Holding other variables like specialty and board certification constant does not appear to affect this relationship, as we shall see later.

Of course, with extensive usual, customary, and reasonable reimbursement methods, stated charges may be inflated and not truly reflect actual payments. For example, data at the bottom of Table 4-2

TABLE 4-3. WEIGHTED CHARGES AND PAYMENTS

BY YEAR BY PHYSICIAN AGE DECILE

AGE GROUP	1973		1975		1978	
	WAFEE	WAPAY	WAFEE	WAPAY	WAFEE	WAPAY
27 - 38	$6.36	$5.41	$7.33	$6.14	$9.18	$7.67
39 - 42	6.14	5.31	7.23	6.00	9.09	7.52
43 - 46	5.94	5.11	7.06	5.82	8.97	7.45
47 - 49	5.91	5.14	6.92	5.77	8.68	7.29
50 - 52	5.91	5.18	6.97	5.81	8.71	7.34
53 - 56	5.81	5.08	6.83	5.69	8.56	7.16
57 - 59	5.67	5.02	6.60	5.59	8.27	7.03
60 - 63	5.78	5.12	6.69	5.68	8.34	7.07
64 - 68	5.71	5.15	6.60	5.63	8.02	6.86
69+	5.59	5.08	6.33	5.56	7.68	6.61

NOTES:

CHG = WAFEE (Average Total Charge per RVU, COL deflated
PAY = WAPAY (Average Blue Shield or Medicare Payment per RVU, COL deflated

show payments to be about one dollar less than charges per RVU, or about 16 percent overall (e.g., for medium MDPOP areas ($5.68 compared to $6.60). Younger physicians still enjoy higher payments, however, in practically every age decile comparison. Moreover, the ratio of average payments to charges is constant within age decile (about 83 percent) until about age 65 when the ratio rises to 88 percent.

It would appear that under Blue Shield and Medicare reimbursement principles, more is being charged by younger physicians, and these higher rates are being passed through in terms of payments. As these charges are already adjusted for both relative value content and cost-of-living, it is hard to explain remaining premiums. A varying specialty mix by physician age cohort is a logical explanation, but can this account for all of the difference in the youngest three deciles? Multivariate work will consider this issue in a more comprehensive fashion later in this report.

Returning to Table 4-2, we further note that both charges and payments per RVU <u>rise</u> with physician density. Low MDPOP areas exhibit average charges of $6.48 compared to $7.36 in high MDPOP areas, a difference of 14 percent. Payments also are higher in more competitive areas, although the discrepancy is only 9 percent. When examined by specialty, the relationship is less clear among the three MDPOP areas. Nevertheless, fees per RVU are about 10 percent higher in high vs. low MDPOP areas, with the largest difference among surgical specialists where fees are 16 percent higher. Nearly identical fee and payment relationships exist holding board certification or age constant. If sheer numbers of direct patient care physicians lead to enhanced competition and lower fees, these simple cross-sectional results do not show it, neither

for the sample as a whole nor for more homogeneous subgroups.

Falling workloads with increased physician supplies are expected as pro rata demand per physician shifts in. Physicians may induce more care, on the other hand, by treating each patient seen more intensively. Regarding this possibility, the results in Table IV-2 are mixed. For GPs and medical specialists the utilization rate per patient seen falls as we move from low to medium MDPOP areas, then rises again from medium to high areas. The rate is consistently negative for surgical specialists, on the other hand. Without a more definitive measure of case mix, it is difficult to explain these results. If patient severity of illness is related to physician density, either within area or due to patient migration, the case mix and competitive effects will be confounded. Why the relationship is not consistent across specialty still is unexplained, however.

D. TRENDS IN PHYSICIAN CHARGES AND PATIENT UTILIZATION RATES

Cross-sectional results provide only a still-life of dynamic market behavior. Tables 4-4 and 4-5 present trends in charges and utilization rates per patient seen by broad specialty group by physician density (low, medium, and high). The first column gives the number of physicians while the last provides the percent change over the six year period.

The single largest group of general and family practitioners, 2,717 physicians in all, showed average fee increases per RVU of 42 percent over the six years, or slightly over 8 percent per annum. Except for the "other" specialties group, this was the lowest rate of fee inflation in

TABLE 4-4. WEIGHTED CHARGES BY SPECIALTY BY PHYSICIAN DENSITY, 1973 - 1978

SPECIALTY/MD DENSITY	(MDS)	1973	1974	1975	1976	1977	1978	% Δ 1973-78
ALL PHYSICIANS		$5.89	$6.19	$6.87	$7.42	$7.95	$8.56	
GP/FP	2717	5.37	5.60	6.18	6.63	7.12	7.64	42%
LOW	1030	5.18	5.39	5.96	6.41	6.89	7.36	42
MEDIUM	742	5.23	5.47	6.02	6.45	6.90	7.44	42
HIGH	945	5.70	5.93	6.54	7.02	7.54	8.10	42
MEDICAL SPECIALISTS	930	6.24	6.56	7.32	7.87	8.43	9.08	46
LOW	194	5.87	6.14	6.90	7.36	7.92	8.52	45
MEDIUM	261	5.89	6.19	6.81	7.35	7.83	8.57	46
HIGH	475	6.59	6.94	7.77	8.36	8.97	9.60	46
SURGICAL SPECIALISTS (EXCL. GS)	1164	6.29	6.64	7.37	8.04	8.55	9.22	47
LOW	336	6.08	6.42	7.08	7.74	8.16	8.83	45
MEDIUM	375	5.97	6.30	7.02	7.61	8.17	8.86	48
HIGH	453	6.72	7.08	7.88	8.61	9.15	9.82	46
OTHER SPECIALISTS	224	6.57	6.87	7.37	7.87	8.42	9.06	38
LOW	63	6.20	6.65	7.10	7.68	8.06	8.51	37
MEDIUM	60	6.24	6.45	7.10	7.33	7.70	8.78	41
HIGH	101	6.99	7.26	7.69	8.32	9.07	9.56	37
INTERNAL MEDICINE	1064	6.08	6.42	7.10	7.60	8.13	8.75	44
LOW	255	5.96	6.23	6.93	7.58	8.07	8.74	47
MEDIUM	328	5.85	6.16	6.76	7.22	7.75	8.30	42
HIGH	481	6.29	6.70	7.42	7.87	8.43	9.07	44
GENERAL SURGEONS	707	5.86	6.19	6.99	7.62	8.16	8.85	51
LOW	268	5.63	5.91	6.59	7.14	7.81	8.51	51
MEDIUM	208	5.57	5.87	6.70	7.24	7.70	8.34	50
HIGH	231	6.39	6.81	7.72	8.50	8.98	9.71	52
OB/GYN	486	6.40	6.91	7.70	8.57	9.23	10.04	57
LOW	121	5.75	6.22	6.98	7.58	8.25	9.02	57
MEDIUM	154	6.11	6.71	7.38	8.28	8.91	9.71	59
HIGH	211	6.98	7.45	8.34	9.34	10.04	10.86	56

TABLE 4-5. WEIGHTED UTILIZATION RATES BY SPECIALTY BY PHYSICIAN DENSITY, 1973 - 1978

SPECIALTY/MD DENSITY (N)	1973	1974	1975	1976	1977	1978	%Δ 1973-78
GPs/FPs	6.24	6.24	6.06	6.06	5.76	5.59	-10.4%
LOW	6.63	6.61	6.36	6.46	6.24	6.01	- 9.4
MEDIUM	5.80	5.83	5.79	5.82	5.61	5.51	- 5.0
HIGH	6.15	6.17	5.95	5.80	5.36	5.20	-15.4
MEDICAL SPECIALISTS	4.98	5.03	4.95	4.71	4.44	4.42	-11.2
LOW	5.10	5.01	4.94	4.48	4.37	4.31	-15.5
MEDIUM	4.48	4.31	4.20	4.02	3.73	3.69	-17.6
HIGH	5.20	5.44	5.36	5.18	4.85	4.87	- 6.3
SURGICAL SPECIALISTS (EXCL. GS)	4.19	4.03	3.87	3.63	3.36	3.16	-24.6
LOW	5.15	4.89	4.60	4.26	4.02	3.79	-26.4
MEDIUM	4.00	3.88	3.71	3.46	3.14	2.86	-28.5
HIGH	3.64	3.52	3.46	3.30	3.04	2.93	-19.5
OTHER SPECIALISTS	3.00	2.98	3.04	2.99	2.91	2.89	- 3.7
LOW	2.78	2.69	2.88	2.82	2.85	2.94	- 5.8
MEDIUM	3.43	3.49	3.26	3.15	2.84	2.69	-21.6
HIGH	2.88	2.85	3.01	3.00	2.98	2.97	3.1
INTERNAL MEDICINE	7.93	7.92	7.80	7.73	7.43	7.30	- 7.9
LOW	8.91	8.70	8.34	8.17	7.92	7.81	-12.3
MEDIUM	7.67	7.61	7.76	7.66	7.38	7.24	- 5.6
HIGH	7.58	7.72	7.54	7.54	7.20	7.07	- 6.7
GENERAL SURGEONS (GS)	2.84	2.94	3.05	2.97	2.88	2.84	0.0
LOW	3.22	3.24	3.35	3.29	3.15	2.93	- 9.0
MEDIUM	2.74	2.84	2.86	2.73	2.73	2.81	2.6
HIGH	2.51	2.69	2.87	2.81	2.71	2.76	10.0
OB/GYN	8.63	8.67	8.56	7.94	6.93	6.69	-22.5
LOW	9.13	9.38	9.24	8.76	7.99	7.70	-15.7
MEDIUM	9.33	9.34	9.43	8.39	7.58	6.97	-25.3
HIGH	7.82	7.77	7.53	7.14	5.85	5.89	-24.7

the sample. OB-GYNs exhibited the highest rate of increase, 57 percent, followed by general surgeons at 51 percent.

As is evident from the last column in Table 4-4, there is practically no difference in the rate of fee inflation by extent of physician competition, even within specialty. If fees were higher in physician-dense areas in the past due to differences in market characteristics, one might have expected market competition to narrow the fee gap over time as physicians face falling workloads and migrate across areas. Nevertheless, no evidence is found of narrowing fees in Table 4-4. General surgeons, for example, who are agreed already to be in oversupply (ACS, 1975), charged $1.20 per RVU more in high vs. low MDPOP areas in 1978 compared to a $.76 difference in 1973. The same pattern holds true within every other broad specialty group, as if fees moved completely independent of physician availability.

Overall utilization rates per patient seen in Table 4-5 would appear to be falling consistently over time -- except for general surgeons where the rate is unchanged. Several factors might explain declining rates. First, many of the 23 procedures that make up the total utilization, or workloads, of our physician panel involve non repetitive surgery, e.g., tonsillectomy, cholecystectomy, resection of prostate, hysterectomy, excision of lens. For an unchanged clientele, organ removal in any period naturally reduces the probability of a similar procedure in subsequent periods. The impact of nonrepetitive surgery on our intensity measure will become more evident when we look at individual procedures. Second, our utilization rates would not automatically reflect population-based utilization rates (U/POP) which can be represented as:

$$U/POP \equiv (U/PAT) \cdot (PAT/MD) \cdot (MD/POP)$$

where U/PAT = utilization per patient seen, PAT/MD = number of distinct patients per physician, and MD/POP = physician population ratio. Utilization rates per capita can be rising over time, even though utilization per patient seen is falling, if physicians are: (a) seeing more patients per period; (b) the supply of physicians per capita is rising; or (c) both.

Another reason for declining utilization is the use of relative values in weighting procedures rather than a simple sum of services. Many of the nonrepetitive surgical procedures in our sample are weighted 40-60 times more than regular office visits. Thus, any downward bias due to this factor is accentuated.

Fourth, several of the selected procedures in our data base have actually been exhibiting declining rates nationally, including tonsillectomies, and obstetrical deliveries (NCHS, 1973, 1977).

Fifth, our study has focused on many well-defined, more routine procedures for which a consistent time-series is available. To the extent physicians have been "upgrading" procedures or expanding into new areas of diagnosis and treatment, our intensity measure would be biased downwards. Vaginal deliveries are a good example of this phenomenon. Over the last decade a pronounced shift in favor of caesarian sections has taken place (ACS, 1975), a shift not reflected in our narrow definition of obstetrical deliveries.

And finally, changes in production and billing patterns for lab and

radiological services can also reduce utilization rates using claims data from a panel of physicians. If physicians are requesting ancillary tests at an increasing rate using outside clinical labs, these are billed separately and are not included in our trends of ancillary utilization per patient seen by a particular physician. While most of the ancillary testing per patient is still growing over time in spite of the use of physician panel claims data, the rates are lower than expected (see Table 4-6 below).

Notwithstanding these problems, the utilization rates in Table 4-5 should have some meaning across physician market areas. If rates per patient seen are falling in our sample, we might expect them to fall less rapidly in competitive areas as physicians provide more services to a more limited patient clientele. With the notable exception of general practitioners and OB-GYNs, this is the case. RVU-weighted utilization per patient seen by medical specialists, for example, fell 15-17 percent over the six years in low and medium MDPOP areas compared to only 6.3 percent in high MDPOP areas. For general surgeons the difference was in direction as well as degree: the rate in low MDPOP areas was -9.0 percent compared to a 10 percent increase in high areas. Changes in exogenous factors (e.g., population growth, changing demographics) may explain most of these differences, and more definitive conclusions must await the multivariate work.

Table 4-6 provides an even more disaggregated picture of trends in fees and utilization rates by individual procedure by degree of physician competition. For brevity only the two end years of the series are shown, along with the annualized percent change. Taking the surgical procedures

TABLE 4-6. PHYSICIAN CHARGES, DEFLATED, AND PATIENT UTILIZATION RATES BY PHYSICIAN AREA BY YEAR BY PROCEDURE

PROCEDURE AND YEAR	PHYSICIAN CONCENTRATION RATIOS: LOW AFEE	LOW URT	MEDIUM AFEE	MEDIUM URT	HIGH AFEE	HIGH URT	TOTAL AFEE	TOTAL URT
Colles Fracture								
1973	$106.63	.034	$101.24	.030	$108.78	.039	$105.48	.034
1978	164.71	.028	161.28	.024	165.02	.024	163.61	.025
% Δ	10.9%	-3.5%	11.9%	-4.0%	10.0%	-7.7%	11.0%	-5.3%
Tonsillectomy								
1973	$ 98.77	.111	$ 91.62	.108	$ 94.55	.134	$ 93.82	.119
1978	164.04	.047	147.72	.037	162.67	.036	156.02	.038
% Δ	13.2%	-11.5%	12.3%	-13.1%	14.4%	-14.6%	13.3%	-13.6%
Proctosigmoidoscopy								
1973	$ 19.55	.104	$ 17.28	.155	$ 19.22	.165	$ 18.72	.142
1978	29.64	.117	26.60	.180	26.81	.166	27.63	.155
% Δ	10.3%	2.5%	10.8%	3.2%	7.9%	.1%	9.5%	1.8%
Cholecystectomy								
1973	$314.39	.030	$318.13	.033	$320.83	.039	$317.47	.033
1978	464.51	.024	462.70	.025	496.18	.024	470.01	.024
% Δ	9.5%	-4%	9.1%	-4.8%	10.9%	-7.7%	9.6%	-5.5%
Herniorrhaphy								
1973	$198.60	.039	$193.75	.037	$204.73	.046	$198.49	.040
1978	302.36	.034	294.97	.037	329.95	.051	307.54	.040
% Δ	10.5%	-2.6%	10.5%	0%	12.2%	2.2%	11.0%	0%

TABLE 4-6. (CONTINUED)

PROCEDURE AND YEAR	PHYSICIAN CONCENTRATION RATIOS						TOTAL	
	LOW		MEDIUM		HIGH			
	AFEE	URT	AFEE	URT	AFEE	URT	AFEE	URT
Resection prostate								
1973	$410.07	.083	$396.76	.092	$417.94	.093	$408.42	.091
1978	579.42	.081	563.57	.076	640.81	.092	599.25	.084
% Δ	8.3%	-.5%	8.4%	-3.5%	10.7%	-.2%	9.3%	-1.5%
D & C								
1973	$ 88.08	.081	$ 87.35	.091	$ 98.32	.083	$ 90.97	.086
1978	137.76	.064	140.47	.078	171.29	.081	149.26	.075
% Δ	11.3%	-4.2%	12.2%	-2.9%	14.8%	-.5%	12.8%	-2.6%
Hysterectomy								
1973	$344.53	.055	$351.51	.059	$370.80	.061	$354.11	.058
1978	506.13	.033	534.29	.036	558.80	.034	531.32	.035
% Δ	9.4%	-8.0%	10.4%	-7.8%	10.1%	-8.9%	10.0%	-7.9%
Laminotomy								
1973	$474.83	.090	$462.87	.046	$502.80	.028	$470.19	.051
1978	680.75	.065	727.30	.041	709.68	.012	717.19	.041
% Δ	8.7%	-5.6%	11.4%	-2.2%	8.2%	-11.4%	10.5%	-3.9%
Excision of lens								
1973	$391.28	.173	$387.52	.163	$401.87	.094	$393.45	.144
1978	571.96	.096	546.23	.080	577.84	.049	565.05	.075
% Δ	9.2%	-8.9%	8.2%	-10.2%	8.8%	-9.6%	8.7%	-9.6%
Obstetrical delivery								
1973	$202.24	.226	$227.40	.264	$262.25	.298	$230.72	.263
1978	324.85	.203	379.00	.198	434.68	.244	379.65	.215
% Δ	12.1%	-2.0%	13.3%	-5.0%	13.2%	-3.6%	12.9%	-3.7%

TABLE 4-6. (CONTINUED)

PROCEDURE AND YEAR	PHYSICIAN CONCENTRATION RATIOS: LOW AFEE	LOW URT	MEDIUM AFEE	MEDIUM URT	HIGH AFEE	HIGH URT	TOTAL AFEE	TOTAL URT
X-ray, Chest								
1973	$ 16.90	.250	$ 17.31	.327	$ 18.68	.340	$ 17.76	.312
1978	21.74	.283	21.89	.347	23.12	.356	22.35	.333
% Δ	5.7%	2.6%	5.3%	1.2%	4.8%	.9%	5.2%	1.3%
Upper GI								
1973	$ 34.86	.128	$ 33.16	.126	$ 38.83	.140	$ 36.38	.133
1978	45.24	.090	45.13	.080	51.38	.117	48.11	.101
% Δ	6.0%	-5.9%	7.2%	-7.3%	6.5%	-3.3%	6.5%	-4.8%
Brief Office Visit								
1973	$ 5.68	1.852	$ 6.14	1.563	$ 6.41	2.202	$ 6.09	1.886
1978	8.73	1.695	9.14	1.367	9.57	1.552	9.16	1.541
% Δ	10.7%	-1.7%	9.8%	-2.5%	9.9%	-5.9%	10.1%	-3.7%
Intermediate Office Visit								
1973	$ 7.66	1.052	$ 8.10	.918	$ 8.96	1.381	$ 8.31	1.150
1978	10.60	1.381	11.36	1.149	12.73	1.703	11.68	1.450
% Δ	7.7%	6.3%	8.0%	5.0%	8.4%	4.7%	8.1%	5.2%
Initial Hospital Visit								
1973	$ 26.85	.321	$ 26.34	.269	$ 28.34	.230	$ 27.18	.272
1978	35.81	.284	36.14	.243	40.14	.200	37.40	.241
% Δ	6.7%	-2.3%	7.4%	-1.9%	8.3%	-2.6%	7.5%	-2.3%
Brief Hospital Visit								
1973	$ 5.58	2.313	$ 5.57	2.009	$ 6.64	1.407	$ 5.87	1.934
1978	8.86	1.412	8.56	1.327	10.18	.891	9.11	1.231
% Δ	11.8%	-7.8%	10.7%	-6.8%	10.7%	-7.3%	11.0%	-7.3%

TABLE 4-6. (CONTINUED)

PROCEDURE AND YEAR	PHYSICIAN CONCENTRATION RATIOS						TOTAL	
	LOW		MEDIUM		HIGH			
	AFEE	URT	AFEE	URT	AFEE	URT	AFEE	URT
Intermediate Hosp Visit								
1973	$ 8.40	1.781	$ 8.20	1.696	$ 9.47	1.705	$ 8.76	1.726
1978	12.02	1.621	12.07	1.561	14.29	1.643	12.92	1.612
% Δ	9.1%	-1.8%	9.4%	-1.6%	10.2%	-0.7%	9.5%	-1.3%
EKG								
1973	$15.54	.297	$14.75	.403	$16.18	.556	$15.65	.451
1978	19.74	.308	19.17	.411	20.15	.505	19.79	.431
% Δ	5.4%	.7%	6.0%	.4%	4.9%	-1.8%	5.3%	-.9%
Urinalysis								
1973	$ 2.35	.263	$ 2.48	.280	$ 2.56	.422	$ 2.49	.353
1978	2.99	.306	3.08	.396	3.47	.462	3.27	.409
% Δ	5.5%	3.3%	4.8%	8.3%	7.1%	1.9%	6.3%	3.2%
Fasting blood sugar								
1973	$ 3.50	.351	$ 3.67	.273	$ 3.78	.507	$ 3.68	.419
1978	4.16	.405	4.20	.340	4.51	.513	4.35	.450
% Δ	3.8%	3.1%	2.9%	4.9%	3.9%	.2%	3.6%	1.5%
Complete blood count								
1973	$ 4.64	.198	$ 4.74	.319	$ 4.94	.318	$ 4.85	.294
1978	5.44	.260	5.66	.444	6.12	.363	5.90	.355
% Δ	3.5%	6.3%	3.9%	7.8%	4.8%	4.3%	4.3%	4.1%
Comprehensive consult.								
1973	$28.49	.159	$27.57	.159	$31.10	.211	$29.29	.180
1978	40.21	.153	39.85	.157	46.78	.203	42.81	.175
% Δ	8.2%	-.8%	8.9%	-.3%	10.1%	-.8%	9.2%	-.6%

first, one might expect a higher rate of fee inflation for more elective procedures, generally, if physicians induce surgery; and less inflation for those procedures that are more or less out of the physician's control. Within procedure, inflation should vary inversely with physician density without inducement. Colles fractures and deliveries, as nondiscretionary procedures, provide a limited control for the more elective procedures. Utilization rates, _ceteris paribus_, should also grow more slowly (or decline more rapidly) for these two services. Confounding this interpretation, however, is the nonrepetitive procedure problem discussed above.

Ranking surgical procedures by the rate of fee inflation, tonsillectomy fees showed the highest rate of increase (13.3 percent), followed by normal deliveries (12.9 percent), and D&Cs (12.8 percent). Charges for Colles fractures were about in the middle (11.0 percent) while lens excisions at 8.7 percent and resections of the prostate (9.3 percent) showed the slowest rates of fee inflation.

The noticeable decline in tonsillectomies per patient seen (13.6 percent per year), like lens excisions, might have discouraged rapid fee inflation for physicians performing these procedures. Yet, inflation rates for these two procedures were at opposite ends of the inflation continuum: tonsillectomies were the highest, while lens excisions were the lowest. A closer examination of the utilization rates for lens excision suggests that the declining rate over time is more apparent than real. For example, assume that opthalmologists perform a certain number of excisions each year (U_t) on their remaining patients who have not undergone such surgery (R_t):

$$\text{(IV.1)} \qquad U_t = r_t \cdot R_t$$

where

$$\text{(IV.2)} \qquad R_t = (R_{t-1} - U_{t-1} + (P_{t-1} - P_{t-1})$$

and r_t = surgery rate in year t adjusted for nonrepetitive surgery, $P_t - P_{t-1}$ = change in the number of patients. The first term in parentheses in equation (IV.2) constitutes the remaining patients after last year that had not had surgery, while the second parenthetical term reflects the growth in new patients potentially eligible for the operation. By reduction, the first term in parentheses can be replaced by the term, $P_{t-1} - \sum_j^{t-1} U_j$, and (IV.2) can be simplified such that:

$$\text{(IV.3)} \qquad U_t = r_t^* \; (P_t - \sum_j^{t-1} U_j \;)$$

or

$$\text{(IV.4)} \qquad r_t^* = U_t \;/(P_t - \sum_j^{t-1} U_j \;)$$

which is considerably different from the unadjusted rate, $r_t = (U/P)_t$.

Without knowing the complete operating history of the physician, we do not have an accurate measure of his cumulative surgeries up to any period. We do know, however, that surgeons in our sample performed 11,777 lens excisions in 1973, almost entirely on 89,000 Medicare enrollees, an unadjusted rate of 13.2 percent. By 1978, the number had fallen to 10,217 even though Medicare patients seen by these surgeons had grown to 152,000,

giving an unadjusted rate of 6.7 percent. Adjusting for cumulative surgery from 1973-77, which totalled 48,070 operations for our sample, increases the actual surgery rate on true candidates to 11 percent in 1978, or only two percentage points less than in 1973. While this adjustment is admittedly crude, it does illustrate the extent of the downward bias in some of the utilization rate trends in Table 4-6 and others given earlier. By way of contrast, proctosigmoidoscopies, which are repetitive diagnostic procedures, apparently do not suffer from previous activity as the positive utilization rates show.

Considering surgical trends across areas of differing physician concentration, we note first that fees are invariably higher as the number of direct patient care physicians increases, even though fees have been deflated by a geographic cost of living index. Furthermore, as in earlier tables, no evidence is found for a narrowing of fee differentials within procedure over time. For seven of the eleven procedures, fees in high MDPOP areas rose faster than in low concentration areas, led by D&Cs and tonsillectomies at 14.8 and 14.4 percent, respectively. Even normal delivery fees rose as fast or faster in high as compared to low and medium MDPOP areas.

Leaving the surgical procedures and turning next to a set of five visits, two office (brief and intermediate) and three hospital (initial comprehensive with exam, brief, and intermediate), we find generally lower fee inflation than for surgery, but no systematic difference between MDPOP areas. There does appear to have been a definite shift away from less to more complicated types of visits, however. Wherein brief office visits fell as a proportion of patients seen from 1.9 in 1973 to 1.5 in 1978,

intermediate visits rose .3 percentage points, leaving the total number of office visits of these two types per patient seen unchanged (approximately 3.0). In 1973 the average yearly bill for three office visits was approximately $21 (= $6.09 (1.89) + $8.31 (1.15)) per patient seen. By 1978, the figure had risen to $31, a 50 percent increase in just five years. If visit proportions had not changed, the cost in 1978 would have been $30.74, a trivial difference, with part of the higher weight given to a more expensive visit being offset by a slower rate of inflation. Still, the relative similarity in charges to begin with would require very wide swings in procedure frequencies to materially affect the overall inflation rate for office visits, at least over a few years.

Brief and intermediate hospital visits show a similar shift, although overall rates have declined for both -- again due to the declining surgery rates per patient seen. As before, fee inflation appears independent of physician concentration.

The last set of services includes six diagnostic tests: chest x-ray, upper GI, EKG, urinalysis, fasting blood sugar, and a complete blood count. Most of these procedures show positive growth rates per patient seen, as expected. Complete blood counts per patients seen, for example, grew at a rate of 4.1 percent per year, followed by urinalysis at 3.2 percent. In 1973, these six tests averaged $21.28 per patient seen, rising to $26.22 by 1978, roughly a 25 percent increase. While a significant increase, this is still far below the increases recorded for surgical procedures and office visits, both of which involve considerable physician input.

If physicians induce demand under increased competition to meet

target incomes, Reinhardt (1978) hypothesizes that it should show up in these ancillary services which require little physician input (and hence, personal cost). As Table 4-6 shows, ancillary intensity is positively correlated with physician concentration. Twenty-eight percent of patients seen in 1978 by low MDPOP physicians had a chest x-ray compared to nearly 36 percent in high MDPOP areas. Rates for the other ancillaries in low and high areas were: upper GI, 9 vs. 12 percent; EKG, 31 vs. 51 percent; urinalysis, 31 vs. 46 percent; blood sugar 41 vs. 51 percent; and a complete blood count, 26 vs. 36 percent. Fees per ancillary procedure are also systematically higher in physician-dense areas, even after COL deflation.

As fees and intensity may be partially explained by the specialist performing the procedure, care must be taken in making comparisons across MDPOP areas. Table 4-7 goes one step further and disaggregates three ancillary procedures (chest x-rays, EKGs, and urinalyses) by the major specialty groups billing Blue Shield and Medicare for the procedure. In our sample 86 radiologists performed the required number of chest x-rays compared to 130 in the "other" specialties group (including therapeutic radiologists). About equal numbers of GPs and internists performed EKGs, while more GPs billed for urinalyses. Of course, GPs are almost three times more plentiful in our physician panel than internists (2,717 vs. 1,064). Thus, only 27 percent of GPs report doing EKGs compared to 73 percent of internists. For urinalyses, the percentages are 20 and 37 percent for GPs and internists, respectively. These percentages did not vary much across internists by MDPOP area, but they more than doubled for GPs between low and high areas of physician concentration. Finally, the

TABLE 4-7. PHYSICIAN CHARGES, DEFLATED, AND PATIENT UTILIZATION RATES BY PHYSICIAN AREA BY YEAR BY SPECIALIST, SELECTED ANCILLARY PROCEDURES

PROCEDURE/	LOW		MEDIUM		HIGH		AVERAGE	
SPECIALTY	FEES	UR	FEES	UR	FEES	UR	FEES	UR
CHEST X-RAY								
- Radiologists	(31)		(11)		(44)		(86)	
1973	$16.68	.21	$16.95	.33	$19.04	.32	$17.93	.28
1978	21.93	.30	22.53	.35	23.65	.37	22.89	.34
- Other	(26)		(56)		(48)		(130)	
1973	$17.71	.33	$17.17	.39	$18.17	.40	$17.65	.38
1978	22.21	.34	21.63	.39	22.53	.35	22.08	.37
EKG								
- GPs/FPs	(199)		(167)		(378)		(744)	
1973	$15.28	.20	$14.61	.29	$16.29	.44	$15.64	.34
1978	19.62	.21	18.45	.28	19.81	.39	19.45	.32
- Medical	(49)		(62)		(135)		(246)	
1973	$15.77	.31	$14.92	.46	$16.55	.73	$15.98	.58
1978	19.92	.35	19.87	.46	21.34	.71	20.69	.58
- Internists	(203)		(216)		(355)		(774)	
1973	$15.52	.39	$14.52	.51	$15.59	.63	$15.27	.53
1978	19.50	.40	19.15	.52	19.79	.56	19.53	.51
URINALYSIS								
- GPs/FPs	(158)		(76)		(318)		(552)	
1973	$ 2.12	.23	$ 2.12	.30	$ 2.45	.41	$ 2.31	.34
1978	2.78	.33	2.60	.37	3.45	.39	3.14	.37
- Internists	(94)		(93)		(206)		(393)	
1973	$ 2.45	.31	$ 2.52	.32	$ 2.50	.46	$ 2.49	.39
1978	3.17	.29	3.29	.42	3.33	.51	3.29	.44

NOTE: Numbers of physicians are given in parentheses.

specialist mix is relatively similar in low and high MDPOP areas but vastly different in medium MDPOP areas where "other" specialists outnumbered radiologists five to one. For urinalysis, it is just the opposite: GPs dominate in low and high areas while similar in number to internists in medium areas.

For both chest x-rays and EKGs, average charges appear unrelated to physician concentration even within specialty, with the possible exception of GPs performing x-rays. Nor is there any systematic difference in fees across specialties performing the identical procedure. Internists, for example, charge about the same for an EKG as a GP. EKG utilization rates do vary systematically by MDPOP area, however, holding provider specialty constant. GPs practicing in low MDPOP areas, for instance, ran EKGs on one out of five patients in 1978, while their counterparts practicing in high MDPOP areas ran an EKG on almost two out of five, a two-fold difference. The difference is somewhat lower for internists, but still dramatic (50 percent).

Urinalyses patterns differ from the other two ancillaries only in that both fees and utilization rates appear to be positively related to physician concentration. Internists charged \$1.07 (= \$3.17 .29) on average for urinalyses per patient seen in low MDPOP areas compared to \$1.70 (=\$3.33 .51) in high MDPOP areas; most of the difference due to intensity. Except in high MDPOP areas, internists also charged significantly more than GPs for presumably the identical urinalysis.

Utilization trends show no consistent patterns within specialty by type of ancillary. Sometimes intensity is growing in high MDPOP areas relative to less competitive areas (e.g., urinalyses for internists),

sometimes it is falling (e.g., urinalyses for GPs, EKGs for internists). Fees, however, are uniformly greater over time, independent of the number of physicians per capita.

In sum, higher ancillary utilization rates in high MDPOP areas cannot be explained away by a varying specialty mix, nor can the failure of average ancillary fees to fall with more competition. It is also unclear why internists charge more on average for urinalyses when they do not for EKGs.

V. ECONOMETRIC FINDINGS

A. EQUATION SPECIFICATION

Many factors besides competition affect fees and services of individual physicians, and tabular analyses have distinct limitations in adjusting for confounding variables. In this section a simple behavioral model is specified that allows for a test of physician inducement holding many of the relevant variables constant.

Assume the following three equation models of physician behavior:

$$\text{(V.1)} \qquad P_d = d(Q_d;N;I;MDQ;METRODRS): \qquad \text{Demand}$$

$$\text{(V.2)} \qquad P_s = s(Q_s;Z): \qquad \text{Supply}$$

$$\text{(V.3)} \qquad Q_d = Q_s \quad S'(p_s;Z) \text{ from (V.2)}: \qquad \text{Equilibrium}$$

where P_d and P_s respectively are the demand and supply prices; Q_d and Q_s are the quantities demanded and supplied; N = vector of patient medical need characteristics; I = vector of ability/willingness to pay characteristics; MDQ = vector of physician characteristics proxying the perceived quality of care; METRODRS = number of direct patient care physicians per capita; and Z = vector of supply-influencing variables. Substituting (V.1) and (V.2) into (V.3) and setting demand and supply prices equal, we derive the reduced-form price ($\bar{P}$) equation

$$(V.4) \qquad \bar{P} = g(N;I;MDQ;Z;METRODRS)$$

which provides a major test of competitive effects on inducement. More physicians per capita in a market area should shift _pro rata_ demands per physician in, lowering equilibrium fees. If it does not, then demand inducement may have occurred.

A second test of inducement involves a similar solution of the model for Q, or physician workloads, which can be decomposed into the service intensity per patient (S/P) times the number of distinct patients seen (P) per period:

$$(V.5) \qquad \bar{Q} \equiv (S/P) \cdot \bar{P} = h(N;I;MDQ;Z;METRODRS)$$

Ceteris paribus, more physicians in an area should lower workloads, although total utilization would likely increase due to price competition. That is, workloads fall, but not as much percentage-wise as the increase in the number of practicing physicians, because (hypothesized) lower prices avoid a strictly proportionate decline. If more physicians are "dividing up" a relatively fixed number of patients, then inducement may be present in the intensity of care provided per patient. Without holding price explicitly constant using simultaneous equation techniques, no output-related test can be considered definitive evidence of inducement, but still it would be important for policymakers to know that increased competition does lead to more intensive care per patient seen. Thus, (V.5) will also be estimated with intensity as a dependent variable.

B. DEPENDENT AND INDEPENDENT VARIABLES

Three basic dependent variables were specified -- one reflecting charges per RVU; one measuring intensity per patient seen; and a third reflecting total services, or workloads, of the physician. Construction of the variables has already been described in the data base section above. Charges, along with other dollar variables, have been deflated by the county-estimated CPI. For the summary file, all dependent variables are derived as weighted sums of the 23 individual services. Thus, charges are per RVU, utilization rates are RVUs per patient seen, and total services are simply total RVUs per physician across 23 procedures for Blue Shield-plus-Medicare lines of business. For individual procedure regressions, no weights are required.

Independent variables are categories by medical need, ability-willingness to pay, physician quality, and supply-influencing. Under medical need we have the percent of population living in urban areas (POPURB), percent minority (POPMINOR), percent female (POPFEM), percent less than five years old (POPLT5), percent greater than 65 (POPGT65), and the population per square mile (POPDENSE). Age, sex, minority status, and urbanization have all been found in past research to affect health status and the need for physician services.

For ability/willingness to pay, we have median school years completed (SCHYRS), unemployment rates (WORKUNEM), percent of workforce that are laborers (WORKLAB), percent of population under poverty level (POPPOV), deflated per capita income (ADJPCINC), and deflated medical assistance and

Medicare Part B payments per capita (MEDAS, MEDB). Schooling, the poor, and laborers may also reflect health status as well, with possible offsetting effects (e.g., laborers are more likely to incur job-related illnesses yet have less health insurance). The ability to pay for medical care should be higher where incomes are higher and fewer people are in poverty, where fewer workers are unemployed, and where Medicaid and Medicare payments per capita are higher.

Demand should also be greater where perceived physician quality is higher. Proxies for quality include whether the practitioner is an M.D. or a D.O. (DEGREE = 1 for M.D.s), whether he is board certified (BOARD), his broad specialty group (SP1 = GP/FP; SP2 = medical specialist; SP3 = surgical specialist), and years since licensure. Board certified M.D.s specializing in medicine or surgery should command higher fees. Years since licensure, or work experience, would be predicted to have an inverted U-shaped relationship to perceived quality, and to fees, as physicians gain skills and referrals over time, then begin to lose patients as skills and referrals decline.

Supply-influencing variables include several of the physician characteristics described above plus hospital beds per 1,000 population (HOSPBDS), deflated local area wage rates (ADJDRWAG) and the physician's willingness to participate in Blue Shield and take Medicare patients on assignment (P1 = Blue Shield participating with Medicare assigned claims exceeding five percent; P2 = Blue Shield nonparticipating with assignment less than five percent; P3 = Blue Shield participating with assignment less than five percent). Hospital beds in an area provide a complementary input to physicians' practices, raising productivity, and increasing

supply -- particularly of surgery. Higher wages for physician inputs should discourage supply and raise wages. According to dual market theory (Sloan, Cromwell, and Mitchell, 1978), physicians who participate in public programs like Medicare do so after private fees, or more accurately, marginal revenues, fall below UCR rates. Inclusion of dummy variables to separate participants from nonparticipants adjusts for market segmentation on the demand side. It may also account for relevant demand/supply variables that have been left out of our independent variable list. Because the physician's participation decision is predetermined, in part, by the strength of demand, and thus is endogenous to fees, participation dummies were excluded from some runs. The regression coefficients were not significantly affected, however, so the dummies are included in the equations shown below.

Finally, in order to capture intertemporal trends in general inflation in input prices, changing technology, and other demand/supply variables for which we had little time series information, yearly time dummies (Y1 - Y5) have been included: Y1 = 1974, ..., Y5 = 1978, with 1973 implicitly included in the constant term.

In addition, two measures of physician supplies, or competition, were used. METRODRS equals the number of direct patient care physicians in the physician's market area (one of 13 areas) per 100,000 population (later scaled per 1,000 in the tables) while GPPER equals the number of GPs and FPs per 100,000. As previously discussed, more physicians per capita should reduce physician demand on a pro rata basis and should lower fees if market fee competition is present. The availability of general practitioners, however, may act as a substitute (or complement) to certain

specialist procedures, and have a negative or positive effect on fees and demand. Separating out nonspecialist supplies permits a more refined analysis of competitive effects on physician behavior.

C. FUNCTIONAL FORM AND ESTIMATION METHOD

Fee, utilization rate, and physician workload variables were regressed on the complete independent variable list using Ordinary Least Squares techniques. A semi-log functional form was used, by taking logs of all dependent variables, to capture nonlinear effects. Thus, coefficients can be interpreted as percent changes in the dependent variable attributable to unit changes in any independent variable. For 0, 1 dummies like board certification, coefficients would reflect average percentage differences in fees, intensity per patient seen, or workloads; for percentage variables like percent of population female, coefficients represent percent changes in fees, etc., due to one hundred percentage point increases in percentage rates (e.g., percent female increasing from .5 to 1.5); while for continuous monetary variables like wage rates, coefficients reflect percent changes attributable to $1.00 increases in the independent variable. As many coefficients were unduly small in absolute terms yet statistically significant, some variables have been further scaled per 1,000. For these variables the unadjusted coefficients can be derived by dividing by 1,000.

A direct test of demand inducement by physicians implies the use of simultaneous equation estimation techniques (like two stage least squares) to isolate pure demand from supply effects. Unfortunately, such software

was unavailable, necessitating an indirect, reduced-form method (OLS). This should be nearly as good, however, if we have accurately and comprehensively represented predetermining demand and supply factors. Nevertheless, using reduced-form methods is not as powerful a method for identifying shift effects as one that uniquely measures demand shifts alone. This is because the reduced-form coefficient for physician supplies will include both an inducement effect (if present) and an offsetting competitive effect. A negative coefficient, therefore, is consistent with positive inducement, with the net effect on fees still being negative. Positive coefficients, on the other hand, are completely unexplainable through competitive forces unless extensive nonprice competition (e.g., longer visits) is present. At bottom, a reduced-form estimation method provides a conservative test of inducement, and negative coefficients can be expected. Whether fees should have fallen even further with burgeoning supplies of physicians remains a legitimate area of investigation.

Regressions were run on several subgroups including: (1) a 20 percent sample of physicians (1,724 physicians) for the summary file, giving 8,620 physician-year data points; (2) separate analyses by specialist group (GPs/FPs, medical and surgical specialists); (3) by participation status (P1 = participating in both Blue Shield and taking assignment on more than 5 percent of claims; P3 = Blue Shield participating yet having less than 5 percent of Medicare claims assigned); and (4) 13 separate samples by individual procedure. Except for the 20 percent sample on the summary file (48,594 observations in all), all subgroups represent all physicians included in the group. The largest

single subsample, 21,660 physician-years in all, included all PBS and Medicare participating physicians while the smallest sample included physicians performing tonsillectomies (672 observations on 112 physicians).

D. ECONOMETRIC FINDINGS: SUMMARY FILE

Tables 5.1 and 5.2 present regression results from the six year longitudinal summary file. The first table of fees, utilization rates, and workloads, is based on a 20 percent sample of all specialties while the second table provides results on fees alone for general practitioners and medical and surgical specialists separately, plus two regressions for participants and nonparticipants. Only coefficients significant at least at the 10 percent level are shown, with five percent levels designated by an asterisk.

Considering Table 5.1 first, we note the superior explanatory power of the fee regression, as shown by the R^2 of .40 as compared to .12 and .18 for the utilization rate and workload equations, apparently due to the strong time trend in fees captured by the individual time dummies. In five years, weighted average fees rose approximately 33 percent, holding other trend factors like demographics and income constant. The biggest jump came in 1975 (9 percent), the year after wage/price controls were lifted. Since then, fees apparently rose 6-7 percent annually, *ceteris paribus*. Time trends for intensity and workloads were negative only for the last year or two of the study, no doubt attributable to declines in nonrepetitive surgery.

TABLE 5-1. REGRESSION RESULTS: SUMMARY FILE, FEES, UTILIZATION RATES, AND WORKLOADS

INDEPENDENT VARIABLES	DEPENDENT VARIABLE (IN LOGS)			
	WAFEE	WURT	WTOTS	VARIABLE MEANS
DEGREE	-.0307*	.3344*	.5389*	.89
BOARD	.0621*	-.2557*		.43
SP1	-.1266*	.8203*	.4384*	.37
SP2	-.0231	.7372*	.5124*	.26
SP3		.2720*		.33
YRSLIC	-.0073*	.0184*	.0703*	27.06
LICSQ (000)	.0590*	-.2761*	-1.4919*	863.71
POPURB (000)				78.73
POPMINOR	-.0057*		2.7855*	11.55
POPFEM		-.0868	-.2815*	52.38
POPLT5	-.0110			6.32
POPGT65	-.0126*		.1485*	12.23
POPDENSE (000)	.0114*			4113.01
SCHYRS				11.66
WORKUNEM	.0052			6.92
WORKLAB				4.72
POPPOV	.0104*		-.0818*	7.63
ADJPCINC (000)	.0170*			5427.96
HOSPBDS (000)			-.6071*	497.48
ADJDRWAG (000)	-.0021			13652.80
MEDAS (000)		1.7048*	4.9396*	55.74
MEDB (000)				22.96
METRODRS (000)		-.7339	1.4933*	162.07
GPPER				22.90
Y1 (1974)	.0529*			.17
Y2 (1975)	.1422*			.17
Y3 (1976)	.2060*			.17
Y4 (1977)	.2628*	-.1953*		.17
Y5 (1978)	.3308*	-.2433*	-.3595*	.17
P1 (P,A)	-.0291*	.4087*	1.1688*	.52
P2 (NP, NA)	.0280	.2130*	.2349*	.02
P3 (P, NA)	-.0210*		-.2058*	.15
CONSTANT	1.7890	5.51580	16.9380	
R^2	.40	.12	.18	
F(DOF)	177(8,589)	39(8,589)	59(8,589)	

TABLE 5-2. REGRESSION RESULTS: SUMMARY FILE, FEES BY SPECIALTY GROUP, PARTICIPATION STATUS

INDEPENDENT VARIABLES	SPECIALTY GROUP			PARTICIPATING STATUS	
	GPs/FPs	Medical Spec	Surgical Spec	Fully Participating	Medical Non-Participating
DEGREE	-.0628*	-.0297*	-.0178	-.0405*	-.0562*
BOARD	.0247*	.0709*	.0318*	.0425*	.0485*
SP1				-.1439*	-.0942*
SP2				-.5688*	-.1104*
SP3				-.0173*	.0593*
YRSLIC	-.0038*	-.0046*	-.0035*	-.0054*	-.0023*
LICSQ (000)				.0368*	-1.3882*
POPURB (000)	-.0051*	-1.365*			
POPMINOR			-.0050*		-.0079*
POPFEM	.0141*				
POPLT5	-.0169*				
POPGT65	-.0147*	-.0203*	-.0148*		-.0165*
POPDENSE (000)		.0065	.0152*	.0066*	.0100*
SCHYRS	-.0231*	-.0337*	-.0258*		
WORKUNEM	.0082*	.0105*	.0145*	.0178*	
WORKLAB	-.0067*	-.0247*	-.0162*	-.0082*	-.0297*
POPPOV		-.0082*		-.0074*	.0088*
ADJPCINC (000)			-.0182*	.0112*	
HOSPBDS (000)		.2452*	.1204*		.0204*
ADJDRWAG (000)	.0013*	-.0085*	-.0026*	-.0014*	-.0071*
MEDAS (000)		.3662*	.4191*	.5347*	.5436*
MEDB (000)		.3985	.5563*	.2704	.4754*
METRODRS (000)	.3265*		.1348*	.2971*	
GPPER	-.0023*	-.0039*		-.0012*	-.0040*
OWNMD		.0011*			
Y1 (1974)	.0301*	.0746*	.0571*	.0412*	.0758*
Y2 (1975)	-.0972*	.1367*	.1101*	.0677*	.1891*
Y3 (1976)	.1641*	.2140*	.1890*	.1382*	.2625*
Y4 (1977)	.2331*	.2860*	.2529*	.2042*	.3327*
Y5 (1978)	.2963*	.3698*	.3246*	.2683*	.3979*
P1	-.0143*	-.0103*	-.0488*		
P2	.0457*	-.0374*	.0627*		
P3	.0226*	-.1367*	.0254*		
CONSTANT	1.6920	2.0124	1.917	2.2371	1.4524
R^2	.37	.36	.33	.41	.38
F (DOF)	317(15,504)	217(11,759)	230(13,811)	512(21,630)	133(6,186)

Board-certified physicians in surgical and other specialties, along with D.O.s, charge higher fees per RVU than GPs or medical specialists, as evidenced by the negative coefficients for DEGREE, SP1 and SP2, together with the positive coefficient for BOARD and DEGREE. GPs, in particular, charge 12.7 percent less per RVU than surgeons and other specialists, or about 10.3 percent less than medical specialists, again holding many other factors constant. The source of this difference will be explored later.

Fees show a regular, rather than an inverted, U-shape relationship with work experience, but the fact that the curve "bottoms out" at 62 years of practice-since-licensure suggests that the relationship is really L-shaped and that fees are consistently lower for older cohorts. Thus, the uniformly falling relative fees as physicians grow older, observed in the descriptive work, is unaffected by confounding factors like specialization and location.

Population density and per capita income both raise fees as predicted, but other socio-demographic factors were less clear. Large minority populations apparently lower fees while poverty populations increase them. Possibly poverty status is a better proxy for health status than just minorities. Holding poverty constant, minorities may simply demand (or have access to) fewer physician services, choosing instead to use nonphysician and hospital outpatient services. Concentrations at both tails of the age distribution also apparently lower demand, which seems counterintuitive for the elderly who have greater medical need and extensive insurance coverage. High unemployment rates are also associated with higher fees which, if accepted at face value, may be attributable to lower worker time prices dominating lower incomes. The

variable may also proxy health status, Blue Shield insurance coverage, and other left-out variables. On the supply side, deflated wage rates physicians must pay for auxiliary personnel is negatively associated with fees rather than the other way around as predicted.

Neither direct patient care physicians per capita nor GPs per capita were significant in the summary fee equation. We interpret this to mean that, on an RVU basis, greater physician concentration does not result in competitively depressed fees for individual physicians in a market area. This is true holding physician credentials, years of experience, cost of living, demand and supply factors, and procedure intensity (RVUs) constant. Nonprice competition (e.g., longer visits, shorter waiting times, better quality surgeons) and greater reduced fees/bad debts in competitive areas may both explain this null finding. Nevertheless, the net result is higher reimbursements than would have occurred if fees were not rigid downwards in more competitive physician markets.

Fees for Blue Shield-participating physicians appear to be 2-3 percent lower than for nonparticipating, Medicare-assigning physicians (the excluded group) and 5-6 percent lower than joint Blue Shield-Medicare nonparticipants. Participating physicians may have stronger charity motives and keep fees lower, or they might take on more cases moving down along their private demand curve and lowering prices. Strict nonparticipators should have higher fees as private demand is very strong, *ceteris paribus*.

The annual average intensity of care per patient seen (about 3.35 RVUs, with a brief office visit = 1.0) clearly is associated with physician training and age although very little related to demographics,

which is somewhat surprising. D.O.s, non-board certified physicians and GPs would appear to provide the most care per patient seen when defined as RVUs across 23 types of procedures. A heavy concentration of brief and intermediate office visits per patient explains the high GP intensity rating, as shown later. Holding specialty and credentials constant, intensity per patient rises with physician work experience, essentially for the physician's working lifetime (or 33 years).

Intensity is also positively related to Medicaid payments per capita. It is impossible to say how much of this is due to greater Medicaid insurance coverage, poorer health status, or even a possible feedback effect of intensity on payments.

Physician concentration appears to be inversely related to intensity, as evidenced by the negative coefficient for METRODRS in column 2, Table 5.1. A strict prorating of patients with greater physician supplies would leave intensity unaffected; physicians would continue to see the same kinds of patients on average, performing similar procedures. Yet, the RVU-based workload coefficient for METRODRS is significant and positive (see column 3), implying more total output per physician, not less. Lower intensity per patient must be more than made up by greater unique patient contacts, which seems counterintuitive. The picture is one of more physicians seeing more patients in physician-dense areas, treating each less intensively on average. The most likely explanation of declining fees bringing forth greater numbers of patients is not supported by the fee regression, as noted previously, and other answers must be considered. Looking at individual procedure regressions may shed some light on this paradox.

Summarizing briefly the aggregate Blue Shield-Medicare physician workload equation, we find that:

- GPs and medical specialists provide more RVUs than surgical and other specialists;
- D.O.s have smaller Blue Shield-Medicare workloads;
- Younger physicians have heavier workloads, peaking at 23 years of work experience;
- Minority male and elderly populations increase physician workloads;
- Hospital beds reduce workloads;
- Medicaid payments raise workloads;
- Greater direct patient care physician supplies imply heavier Blue Shield-Medicare workloads;
- Fully participating physicians have greater workloads (which is not surprising given that workloads include only Blue Shield and Medicare patients); and
- Strictly nonparticipating physicians also have greater workloads (which cannot be attributed to claims data limitations).

Table 5.2 provides a slightly more disaggregated look at the fee equation alone. As GPs and FPs make up a large percentage of our sample (roughly 37 percent), it is not surprising that the fee equation for GPs/FPs alone is quite similar to the first one presented. The two notable differences are:

- Higher wage rates facing GPs/FPs lead to higher fees (rather than the opposite for the whole specialty sample); and
- Greater GP supplies appear to competitively lower fees per RVU while non-GP competition raises them.

The latter result is consistent with earlier findings (Steinwald and Sloan, 1974), reinforcing the notion of orthodox neoclassical markets -- at least for general practitioners. Why GP fees should be higher where there are more direct patient care physicians per capita is unknown, nor is it explained in earlier work. If specialists complement GPs through referrals, GPs could charge higher fees, but referrals are usually in the opposite direction, i.e., from GPs to specialists. Why greater specialist supplies should encourage GPs to charge higher fees, particularly when the former are likely being forced to carry out more routine care, thereby competing more directly with GPs, remains unexplained. In any event, the rapid decline in GPs nationally, given the nature of the market for GP services, would appear to have negative consequences for both GP and specialist fees.

The results for medical and surgical specialists, while similar to GPs in credentials, training, and work experience, differ in key respects. First, specialists COL-adjusted fees tend to be higher in denser urban areas while no such effect was found for GPs. Second, unlike GPs, the level and distribution of per capita income affect specialists' fees; the higher is per capita income, the higher are surgeons' deflated fees, while fewer people in poverty is associated with higher medical specialists' fees. Third, total public program payments per capita (Medicaid and Medicare) are strongly related to specialists fees: greater total payments, higher fees.

Competitive relationships also appear very different. For medical and surgical specialists, three physician-population ratios have been used; including METRODRS, GPPER, and OWNMD, the last of which reflects

the relative concentration of either medical or surgical specialists depending on the physician sample. For medical specialists, fees are unrelated to total physician supplies, positively related to medical specialists per capita (as evidenced by the positive coefficient on OWNMD), and negatively related to general practitioner supplies. An increase of 10 medical specialists per 100,000 (above a mean of 34) would, according to our results, lead to a $.08 increase in their fees per RVU. The corresponding elasticity is .037 percent so that a 10 percent increase in medical specialist concentration would lead to a .37 percent increase in fees. Offsetting this to some extent would be any increases in GP concentration, which has a negative, competitive effect on medical specialist fees. The cross-price elasticity with respect to GP supplies is -.089. Holding the total number of direct patient care physicians (METRODRS) constant, 10 percent increases in both GPs and medical specialists per capita would be associated with declining fees. If specialists increased relative to GPs, however, then our results imply rising fees. Fee competition in the medical specialists market apparently comes not from direct, but interspecialty, pressures. Again, the declining proportion of GPs in physician supplies does not look good for future competition.

No such own- or inter-specialty competitive effects were found for surgical specialists. A statistically strong, positive correlation was found, however, between surgical fees and total physician supplies, although the elasticity is quite small (.02). This is partly consistent with earlier work by Steinwald and Sloan (1974, p. 506-7), although they show a negative own price elasticity for appendectomies (a procedure not

likely to be inducible). (Results on individual procedures are reported in the next section.) No evidence is found, therefore, for a competitive effect on surgeons' fees, in fact, just the opposite, which is particularly surprising given excess supplies in most areas.

Finally, the relationship between fees and physician participation status differs dramatically by specialty group (compare the P1, P2, and P3 coefficients in columns 1-3 of Table 5.2). Medical specialists differ from both GPs and surgeons in terms of fees when it comes to Medicare assignment. While non-assigning GPs and surgeons generally set higher fees, medical specialists are just the opposite. In fact, medical specialists who participate in Blue Shield but do not take assignment set fees 13.7 percent lower than non-participating, non-assigning physicians and 10 percent lower (.137 - .037) than fully nonparticipating (P2) physicians. Dual market theory predicts P2 physicians to set the highest fees, followed by P3, Blue Shield-only participating physicians, but evidently this is not the case. Intraspecialty differences may explain this anomaly, but this is unknown.

How does fee determination vary by physician participation in Blue Shield and Medicare? The last two columns of Table 5.2 provide fee models for fully participating (P1) and Medicare nonparticipating (P3) physicians, both of which can be contrasted against the entire sample of physicians in column 1, Table 5.1. We note, first, from a comparison of coefficients for Y5, the 1978 time dummy, that average fees per RVU have risen much faster for non-assigning physicians, holding all other factors constant. Over five years, non-assigning fees rose nearly 40 percent compared to only 27 percent for fully participating physicians, with most

of the difference coming in 1975, the year after wage-price controls were lifted. Average fees per RVU, however, were actually slightly lower for non-assigning physicians ($6.72 vs. $6.90 for fully participating physicians), implying that at least part of the differential in inflation rates reflects a catching up phenonemon. More rapid fee inflation of non-assigning physicians may also imply a relatively greater out-of-pocket burden for the elderly poor who must pay for fee increases above the Medicare allowable when the physician refuses assignment.

Another interesting comparison concerns the impact of Medicare Part B expenditures per capita on fees. Where expenditures are higher, physicians' fees are also higher, no doubt due to the insurance effect on demand. Yet, higher expenditures appear to have a stronger effect on non-assigning fees. A one dollar increase in Medicare expenditures per capita raises non-assigning fees per RVU by about $.02 vs. less than a penny per RVU for fully participating physicians. While some of this effect may be due to a feedback effect of physician fees on Medicare Part B expenditures and, therefore, not strictly causal, it is indicative nonetheless of the higher costs to both the government and to patients of non-assignment.

Competitive effects appear similar to those already mentioned. A greater abundance of general and family practitioners appears to competitively depress charges, while more of all physicians in an area shows no competitive effects on charges. Indeed, for fully participating physicians, more non-GPs in an area per capita is associated with statistically higher fees per RVU, holding such things as broad specialty mix constant. Unfortunately, we do not know whether these charges

accurately represent transactions prices or if the physician is incurring large bad debts. Medicare-assigning physicians do have an incentive under CPR reimbursement to keep stated fees high, as they enter his charge profile and increase the probability of higher allowables in the future. If this is the case, we may be observing a quirk of the third party reimbursement system with physician competition a motivating factor, viz., more competition reducing revenues and encouraging physicians to raise stated fees for purposes of obtaining greater third party reimbursement in the future.

E. ECONOMETRIC FINDINGS: THIRTEEN PROCEDURES

Tables 5.3 and 5.4 present fee and utilization rate equations for 13 of the 23 individual procedures. The 13 include one diagnostic and 5 therapeutic surgical procedures; a chest x-ray; two kinds of office and one hospital visit; an EKG; and two pathology tests. All equations are specified as before, except that OWNMD has been dropped. Concentrating on competitive effects, Table 5.5 presents three coefficients from the fee and utilization equations reflecting the impact of inflation (Y5) and physician supplies (METRODRS and GPPER).

In terms of overall fee inflation, we have already shown in the descriptive results the relatively higher inflation for surgical procedures. We also find this for many individual procedures, holding income, insurance, and other demand and supply variables constant. Tonsillectomy fees exhibit the greatest increase over the period, 85.5 percent, followed by Colles fracture reductions at 71.4 percent, and

TABLE 5-3. (Page 1 of 4)

REGRESSION RESULTS: INDIVIDUAL PROCEDURE FILES; FEES (IN LOGS)

INDEPENDENT VARIABLES

	Colles Fracture	Tonsillectomy	Proctosig-moidoscopy	Herniorraphy
DEGREE	- .2157*		- .1124*	
BOARD				0.0712*
SP1			- .0493*	
SP2			.0711*	- .1890*
SP3				
YRSLIC	- .0226*	- .0193*	.0142*	.0118*
LICSQ (000)	.2841*	.2193*		- .2977*
POPURB (000)	5.5717*			1.9133*
POPMINOR		.0189*	.0140*	.0139*
POPFEM	- .4438*	.0613*		
POPLT5				.0425*
POPGT65	.0767*	- .0599*		.0221
POPDENSE (000)	.0283	.0546*		- .0228*
SCHYRS	.2567*	- .1499*		
WORKUNEM			.0378*	.0267*
WORKLAB		- .0367*	.0070	
POPPOV			- .0226*	- .0198*
ADJPCINC (000)	- .1738*	- .1155*		
HOSPBDS (000)	.3618*		- .0100*	
ADJDRWAG (000)		- .0075*		
MEDAS (000)			.6658*	1.875*
MEDB (000)				
METRODRS (000)		.4380		
GPPER	.0147*	- .0039*		
Y1 (1974)	.1126*	.1553*	.0304*	.0609*
Y2 (75)	.2686*	.3268*		
Y3 (76)	.4426*	.4960*	.1187*	.1723*
Y4 (77)	.5751*	.6201*	.1649*	.2355*
Y5 (78)	.7140*	.8549*	.2994*	.3165*
P1	.0487	- .0676*	.0285*	- .0323*
P2		.0789*		
P3		- .0792*	- .0494*	
CONSTANT	23.7403	4.9136	2.5725	7.1897
R^2	.4651	.61	.38	.4974
F (DOF)	19(518)	35(641)	74(3831)	36(984)

TABLE 5-3. (Page 2 of 4)

REGRESSION RESULTS: INDIVIDUAL PROCEDURE FILES; FEES (IN LOGS)

INDEPENDENT VARIABLES	Lens Excision	OB Delivery	Chest X-Ray	Brief Office Visit
DEGREE			- .0698*	.0215*
BOARD	- .0225	.0274*		.0681*
SP1		- .2804*	- .1127*	- .1188
SP2			- .0334*	
SP3			- .0899*	
YRSLIC	- .0096*			- .0023*
LICSQ (000)	.0944*			- .0385*
POPURB (000)	-1.4902*	1.1946*	-2.6966*	.6113*
POPMINOR	- .0086*	- .0086*	.0163*	
POPFEM		.0363*	.0770*	- .0210*
POPLT5	- .0315*	.0335*	- .0768*	- .0183*
POPGT65		- .0171*	- .0647*	
POPDENSE (000)		.0221*	- .0273*	
SCHYRS	.0603*		.2286*	
WORKUNEM	.0285*	- .0069	.0298*	.0118*
WORKLAB		- .0108	- .0317*	
POPPOV		.0075	- .0244*	.0045*
ADJPCINC (000)		.0240*		
HOSPBDS (000)				
ADJDRWAG (000)	.0059*		- .0066	- .000003*
MEDAS (000)		.3655	.8485*	.0041
MEDB (000)		.0059		
METRODRS (000)				.2130*
GPPER			- .0025	- .0017*
Y1 (1974)		.0968*		.0461*
Y2 (75)		.2407		.1383*
Y3 (76)		.3440*		.2114*
Y4 (77)	.0824*	.4415*		.2625*
Y5 (78)	.1402*	.5224*		.3369*
P1	.0472*	- .0179	.0229	- .0075*
P2		- .0775*		
P3		.0378*		- .0159*
CONSTANT	6.0766	3.2042	3.0717	
R^2	.48	.6938	.2913	.3619
F (DOF)	42(1,231)	153(1,979)	18(1,275)	518(29,151)

TABLE 5-3. (Page 3 of 4)

REGRESSION RESULTS: INDIVIDUAL PROCEDURE FILES; FEES (IN LOGS)

INDEPENDENT VARIABLES	Intermediate Office Visit	Intermediate Hospital Visit	EKG	Urinalysis
DEGREE		- .0939*	- .0874*	- .0493*
BOARD	.1011*	.0409*		.0865*
SP1	- .2462*	- .0621*	- .1053*	- .1934*
SP2	- .0702*	.0781*	- .0520*	- .0746*
SP3		.0530*		
YRSLIC	- .0021*	- .0041*	- .0028*	- .0183*
LICSQ (000)				.2240*
POPURB (000)	- .8015*	-1.4959*		
POPMINOR	.0049*		.0068*	
POPFEM	.0171*			
POPLT5	- .0231*	- .0227*		
POPGT65	- .0166*	- .0268*		
POPDENSE (000)		.0080*		
SCHYRS		- .0532*		
WORKUNEM	.0114*	.0173*	.0209*	.0108*
WORKLAB	- .0049	- .0228*	.0058	
POPPOV			- .0175*	
ADJPCINC (000)		.0187*		
HOSPBDS (000)		.1822*	- .0615*	
ADJDRWAG (000)	- .0021*			
MEDAS (000)	.1790		.2421*	
MEDB (000)	.1114*	.1825*		
METRODRS (000)	.1091	.3124*		.8180*
GPPER				- .0036*
Y1 (1974)	.0342*	.0347*	.0201*	.0280
Y2 (75)	.0770*	.0649*		.0493
Y3 (76)	.1446*	.1292*	.0671*	.1003*
Y4 (77)	.1966*	.1678*	.1274*	.1326*
Y5 (78)	.3012*	.2753*	.1774*	- .1837*
P1	- .0102*		- .2192*	
P2	.1080*			.0717*
P3	- .0286*	- .0799*	- .0273*	
CONSTANT	1.7134	2.8367	2.9583	2.3094
R^2	.42	.27	.24	.18
F(DOF)	454(20,241)	177(15,381)	104(10,575)	50(6,987)

TABLE 5-3. (Page 4 of 4)

REGRESSION RESULTS: INDIVIDUAL PROCEDURE FILES; FEES (IN LOGS)

INDEPENDENT VARIABLES

	Complete Blood Count			
DEGREE	- .0391*			
BOARD				
SP1				
SP2				
SP3				
YRSLIC	- .0045*			
LICSQ (000)				
POPURB (000)				
POPMINOR				
POPFEM				
POPLT5				
POPGT65	- .0177*			
POPDENSE (000)				
SCHYRS				
WORKUNEM	.0128*			
WORKLAB	- .0306*			
POPPOV	.0199*			
ADJPCINC (000)				
HOSPBDS (000)				
ADJDRWAG (000)				
MEDAS (000)				
MEDB (000)				
METRODRS (000)	.2284			
GPPER				
Y1 (1974)	.0264			
Y2 (75)				
Y3 (76)	.0566			
Y4 (77)	.0763*			
Y5 (78)	.1180*			
P1				
P2	.0752*			
P3	.0238			
CONSTANT				
R^2	.1195			
F(DOF)	24(5,445)			

TABLE 5-4. (Page 1 of 4)

REGRESSION RESULTS: INDIVIDUAL PROCEDURE FILES; URT (IN LOGS)

INDEPENDENT VARIABLES	Colles Fracture	Tonsillectomy	Proctosig-moidoscopy	Herniorrhaphy
DEGREE	- .4422*	- .4004*		.6676
BOARD		- .2022*	- .0726	.1067
SP1		-1.1833		
SP2			1.1085*	
SP3			1.2775*	
YRSLIC	- .0592*			
LICSQ (000)	1.1736*			.9356*
POPURB (000)		7.6060*	7.8543*	
POPMINOR	- .0527		- .0651*	.0454*
POPFEM	- .7564*	- .2975*		
POPLT5				.2540*
POPGT65	.3387*	.2010*	- .0523	.1119*
POPDENSE (000)		7.8784	.0801*	- .1480*
SCHYRS		.4219*	- .3315*	.2566*
WORKUNEM			- .0323	
WORKLAB	- .2078*	.2943*	- .0751*	
POPPOV		- .1140*	.0783*	.0724*
ADJPCINC (000)	- .3913*		.2508*	.2073*
HOSPBDS (000)	-1.2611*	-1.1902*		- .6187*
ADJDRWAG (000)	- .0381	.0321*		
MEDAS (000)		3.5887*	3.8767*	
MEDB (000)				
METRODRS (000)				
GPPER		- .0166*		.0123*
Y1 (1974)	.4779*	- .4971*		
Y2 (75)	.8156*	- .9373*		
Y3 (76)	.6937*	-1.2583*	- .2192	- .4223*
Y4 (77)		-1.3383*	- .4969*	- .5130*
Y5 (78)		-1.9562*	- .7121*	- .7387*
P1	.6497	- .1509*	- .3023*	
P2			.4620*	
P3		.6115*		.4693*
CONSTANT	33.5745	5.5660	3.0219	-7.3301
R^2	.2138	.36	.12	.1684
F(DOF)	6(518)	14(641)	18(3,831)	8(984)

TABLE 5-4. (Page 2 of 4)

REGRESSION RESULTS: INDIVIDUAL PROCEDURE FILES; URT (IN LOGS)

INDEPENDENT VARIABLES	Excision of Lens	OB Delivery	Chest X-Ray	Brief Office Visit
DEGREE	.5356*	.3536*	.6624*	- .3669*
BOARD			- .1813*	- .6626*
SP1		- .7939*	- .6539*	.4594*
SP2				- .3797
SP3				- .7116*
YRSLIC		.0229*		.0175*
LICSQ (000)	- .3433	- .5300*		
POPURB (000)	3.8584		12.1965*	
POPMINOR			.0674*	.0276*
POPFEM	- .1347*			.1082*
POPLT5		.0711	.1731	.1842*
POPGT65	.1089*		.2071*	
POPDENSE (000)				- .0291*
SCHYRS				- .4333*
WORKUNEM	- .0355	.0301*		
WORKLAB	.1480*			- .0515*
POPPOV	- .0420			- .0630*
ADJPCINC (000)			.1843	
HOSPBDS (000)		- .4672*	-1.4367*	.4381*
ADJDRWAG (000)				- .00002*
MEDAS (000)		1.5060*		- .0241*
MEDB (000)				
METRODRS (000)	-1.2888*	.1179*		
GPPER		- .0111*	.0392*	- .0071*
Y1 (1974)				
Y2 (75)				.1379*
Y3 (76)				
Y4 (77)		- .3106*		
Y5 (78)		.3503*	- .6596	
P1		- .2401*	.1747*	- .5189*
P_2				.2657*
P3				.3353*
CONSTANT	1.5474	-4.9124		
R^2	.29	.2521	.0968	.2986
F(DOF)	19(1,231)	24(1,979)	5(1,275)	389(29,151)

TABLE 5-4. (Page 3 of 4)

REGRESSION RESULTS: INDIVIDUAL PROCEDURE FILES; URT (IN LOGS)

INDEPENDENT VARIABLES	Intermediate Office Visit	Intermediate Hospital Visit	EKG	Urinalysis
DEGREE		- .1268*		
BOARD	.2852*	- .1257*		
SP1	.3326*	.4274*		.3764*
SP2	.1781	.8557*	.4151*	.3022*
SP3	- .6680*	- .9152*	- .6270*	.5547*
YRSLIC	.0113*		.0157*	.0125*
LICSQ (000)	.1626*		- .1883*	.1797
POPURB (000)	2.4826*	8.3046**	2.2742*	
POPMINOR			.0183*	
POPFEM		- .0782*		- .1522*
POPLT5		.1236*	- .1155*	- .0901*
POPGT65		.0816*	- .0619*	
POPDENSE (000)				.0575*
SCHYRS		.3996*		
WORKUNEM	.0576*		.0392*	
WORKLAB	.1360*	.1094*		- .0656*
POPPOV				
ADJPCINC (000)			.1669*	.0895*
HOSPBDS (000)	- .4187*	- .8357*	- .3957*	
ADJDRWAG (000)				
MEDAS (000)	1.9347*	3.7959*		
MEDB (000)				
METRODRS (000)		- .9500*	- .6032	
GPPER	.0046	.0104*	.0066*	
Y1 (1974)	.2774*	.1145*	- .0746*	
Y2 (75)	.1245	.1320	- .2406*	.2729*
Y3 (76)			- .4195*	
Y4 (77)			- .5669*	
Y5 (78)			- .6744*	
P1	- .3299*	.2553*	.0500*	
P2		- .5737*	.1923*	.2735*
P3	.2341	- .6361		
CONSTANT	-1.9881	-4.1899	-2.5113	5.6381
R^2	.18	.23	.16	.10
F(DOF)	138(20,241)	148(15,381)	64(10,575)	25(6,987)

TABLE 5-4. (Page 4 of 4)

REGRESSION RESULTS: INDIVIDUAL PROCEDURE FILES; URT (IN LOGS)

INDEPENDENT VARIABLES	Complete Blood Count			
DEGREE	- .1559*			
BOARD				
SP1	- .3918*			
SP2				
SP3	- .5444*			
YRSLIC	- .0281*			
LICSQ (000)	.5775*			
POPURB (000)				
POPMINOR				
POPFEM				
POPLT5	- .1671*			
POPGT65				
POPDENSE (000)				
SCHYRS				
WORKUNEM	.0588*			
WORKLAB	- .0788*			
POPPOV	.0885*			
ADJPCINC (000)	.2517*			
HOSPBDS (000)	.6364*			
ADJDRWAG (000)	.0164			
MEDAS (000)				
MEDB (000)				
METRODRS (000)	-2.0093*			
GPPER				
Y1 (1974)				
Y2 (75)				
Y3 (76)	- .2770*			
Y4 (77)	- .3456*			
Y5 (78)	- .5168*			
P1	- .1356*			
P2	- .2353*			
P3	.2528*			
CONSTANT				
R^2	.0945			
F (DOF)	19(5,445)			

TABLE 5.5 PHYSICIAN COMPETITION AND INFLATION FOR FEE UTILIZATION EQUATIONS -- 13 SELECTED PROCEDURES

	%Δ --1973-78(Y5)--		--METRODRS---		---GPPER----	
Procedure	Fees	URT	Fees	URT	Fees	URT
SURGERY:						
Colles Fracture	71.4%	---	---	---	.0147	---
Tonsillectomy	85.5	-195.6%	.438		-.0039	-.0166
Proctosigmoidoscopy	29.9	- 71.2	---	---	---	---
Herniorrhaphy	31.7	- 73.9	---	---	---	.0123
Lens Excision	14.0	---	---	-1.289	---	---
Vaginal Delivery	52.2	35.0	---	.1179	---	-.0111
DIAGNOSTIC:						
Chest X-Ray	---	- 66.0	---	---	.0025	.0392
EKG	17.7	- 67.4	---	- .6032	---	.0066
VISITS:						
Brief Office Visits	33.7	---	.213	---	-.0017	-.007
Intermediate Office	30.1	---	.109	---	---	.0046
Intermediate Hospital	27.5	---	.312	- .95	---	.0104
PATHOLOGY:						
Urinalysis	18.4	---	.818	---	-.0036	---
CBC	11.8	- 51.7	.228	-2.01	---	---

obstetrical deliveries at 52.2 percent. The diagnostic and pathology tests showed the lowest rates of fee increases, ranging from 0 percent for chest x-rays to 18.4 percent for a urinalysis. Office and hospital visits were between surgery and testing in terms of inflation. It must be remembered that these changes represent increases over and above those explained by time trends in income, and Medicare-Medicaid payments per capita, which undoubtedly reflect average inflation levels to some extent. For some procedures to be showing such high inflation rates under these circumstances is unexpected.

The effects of physician supplies on fees clearly depend on physician specialty mix and type of procedure. Holding the number of GPs constant, no evidence is found of lower fees in more competitive physician areas. All six of the 13 coefficients for METRODRS that were statistically significant were positive, implying higher, not lower fees in areas with more specialists per capita. More GPs, by contrast, do appear to act as a competitive break on fees, at least in four out of five instances where GPPER was significant.

In those cases where METRODRS was positively related to fees, it was for patient visits and pathology test primarily, with the notable exception of tonsillectomies. Most surgical procedures, chest x-rays, and EKGs showed no relationship to physician concentration. Given the general oversupply of surgeons, it is surprising that more price-competitive behavior is not observed for such simple procedures as tonsillectomies and herniorrhaphies.

Among the surgeries, fractures and deliveries were originally selected because they should be less subject to physician inducement, and

individual physician demand should be a simple proration of aggregate area need. Yet, neither of these procedures exhibit any competitive effects in terms of fees; indeed, GPPER is positively related to average fees for fracture reductions.

Reinhardt (1978) has hypothesized that physicians would be more likely to induce services that are not intensive users of their time. Thus, if inducement exists, it is most likely to be evidenced with radiology and pathology procedures. Our results provide some evidence for this hypothesis, but only for pathology. Charges for urinalyses appear to be especially inducible. A coefficient of .818 for METRODRS in the fee equation is associated with an elasticity of .15; a ten percent increase in the number of physicians per capita results not in a fall, but an increase in urinalysis charges of 1.5 percent. This is true holding specialty, geographic cost-of-living, and other factors constant.

Turning, finally, to competitive effects on visits, a positive correlation of physician supplies and fees is discovered for all three visit types. Apparently, non-GP physicians with similar credentials charge higher visit fees in areas with more direct patient care physicians per capita. This is true for brief office visits, for intermediate office visits, and for intermediate hospital visits as well. Because we are unsure of the exact content of these visits, care must be taken in citing this as *prima facie* evidence of inducement. Physicians may be engaged in various forms of nonprice competition (e.g., longer visit lengths, nicer waiting rooms) in areas where their colleagues are more plentiful. Whether this can turn the signs of these coefficients around, however, is doubtful. (For the rather marginal effects of amenities on fees see Sloan

and Lorant (1976, 1977) and Sloan (1980)). Nor can we be certain that physicians in more competitive areas are paid in full; reduced fees and bad debts may well explain at least part of their higher stated charges. But if this is the case, why don't they keep charges more in line with what patients are willing to pay? Possibly for reimbursement purposes? UCR modes of reimbursement may be more extensive in physician-dense areas, contributing to the incentive to keep fees high. Physicians apparently are successful in this regard, as we have already seen in earlier comparisons of fees and Blue Shield/Medicare payments. If this is the case, however, public programs using CPR reimbursement would not enjoy the advantages of greater competition as payments are based on stated, not transactions, prices.

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